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MCCA

MANUFACTURERS COUNCIL ON COLOR AND APPEARANCE

COLLABORATIVE REFERENCE PROGRAM
COLOR AND APPEARANCE

COLOR AND COLOR DIFFERENCE

REPORT NO. 31

NBSIR 80-1830

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1980

U.S. DEPARTMENT OF COMMERCE

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MANUFACTURERS COUNCIL ON
COLOR AND APPEARANCE

COLLABORATIVE REFERENCE PROGRAM
FOR
COLOR AND APPEARANCE

COLOR AND COLOR DIFFERENCE

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U. S. DEPARTMENT OF COMMERCE
National Bureau of Standards

NBSIR 80-1830

INTRODUCTION

The NBS-MCCA Collaborative Reference Program for Color and Appearance is sponsored by the Manufacturers Council on Color and Appearance and the National Bureau of Standards. Four times per year, paint chip samples and near white paper samples, along with a white calibration check sample, are distributed to participating laboratories. Participants in the paint chip test receive two pairs of color samples (from the full color spectrum) along with a white calibration sample. Participants in the near white paper test receive two sets of eight near white papers along with a white calibration sample. Laboratories can participate in either or both tests. The samples are tested by the laboratories and the data is returned to NBS for analysis.

Each test is analyzed in both X,Y,Z and L,a,b color spaces. The X,Y,Z space analysis is primarily for spectrophotometers while the L,a,b space analysis is primarily for colorimeters. A laboratory must specify in which space it wishes to receive its analyses.

Data from each laboratory is processed in a "normal" and an "adjusted" analysis. In the "normal" analysis, the laboratory's data is used as reported. In the "adjusted" analysis, the laboratory's data if first adjusted using a correction factor generated from the laboratory's white calibration sample data (see Explanation of Data For White Sample).

For comparison purposes, reflectance values for single specimens of the paint chip samples at 40 wavelengths ranging from 380 to 770 nm and colorimetric data for 45/0 reflectance factor have been provided by NBS.

Also for comparison purposes, a plot of the spectrophotometric curves of single paint chip specimens was provided by Hemmendinger Color Laboratory, Belvedere, New Jersey.

If there are any questions on the notes, analyses, or the report in general, contact Jeffrey Horlick on (301) 921-2946 or Thomas L. Cummings on (703) 442-0433.

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KEY TO TABLES

MEAN -	The average of individual test determinations.
GRAND MEAN - (GR. MEAN)	The average of the individual laboratory MEANS, excluding laboratories flagged (see column F) with an X, #, or +.
SD OF MEANS -	The standard deviation of the laboratory MEANS about the GRAND MEAN: an index of the among-laboratory precision.
INST CODE -	Code for instrument type and color space used to report measurements, see Table of Instrument Codes

F - Flag, is based on ΔE column with the following meaning:

0 -	Included in grand mean analysis.
* -	Included in grand means but results are between two and three standard deviations. The participants should take this as a warning to reexamine testing procedures.
X -	Excluded from all calculations because ΔE is beyond (3) standard deviations.
+ -	Excluded from all grand mean calculations because lab is using a nonstandard instrument or test method.
# -	Excluded from all grand mean calculations because data were not understood, data were extreme, late, or insufficient information was supplied concerning instrument and test method used.

Note: In addition to flag (F) based on delta E column, it is also possible to have either an X or an * on individual MEANS as follows:

X - following a MEAN signifies that the mean is greater than 3 SD of MEANS from the Grand Mean. The values for this laboratory have been omitted in the calculations involving the MEAN for the column.

* - following any of the MEANS signifies that the quantity is greater than 2 but less than 3 of the appropriate standard deviations from the corresponding average. The participant should take this as a warning to reexamine his testing procedures.

ΔE - Total color difference between two samples. In X, Y, Z analysis it is calculated in MacAdams (FMC II) units. For L, a, b analysis it is calculated in Hunter units.

ΔE Calculation

ΔE is calculated in the Color and Color Difference Collaborative Reference Program by the FMC2* equations (X, Y, Z analysis) as follows:

The yellow-blue chromatic difference is

$$\Delta C_1 = K_1 S(P\Delta P + Q\Delta Q)/bD^2 - K_1 \Delta S/b;$$

the lightness difference is

$$\Delta L = 0.279K_2(P\Delta P + Q\Delta Q)/aD;$$

and the red-green chromatic difference is

$$\Delta C_3 = K_1(Q\Delta P - P\Delta Q)/aD.$$

The quantity, D, is an abbreviation,

$$D = (P^2 + Q^2)^{\frac{1}{2}}.$$

$$K_1 = 0.55669 + 0.049434\, Y - 0.82575 \cdot 10^{-3} Y^2 + 0.79172 \cdot 10^{-5} Y^3 - 0.30087 \cdot 10^{-7} Y^4,$$

$$K_2 = 0.17548 + 0.027556\, Y - 0.57262 \cdot 10^{-3} Y^2 + 0.63893 \cdot 10^{-5} Y^3 - 0.26731 \cdot 10^{-7} Y^4,$$

$$a^2 = 17.3 \cdot 10^{-6}(P^2 + Q^2)/[1 + 2.73P^2Q^2/(P^4 + Q^4)],$$

$$b^2 = 3.098 \cdot 10^{-4}(S^2 + 0.2015\, Y^2)$$

$$P = 0.724\, X + 0.382\, Y - 0.098\, Z,$$

$$Q = -0.48\, X + 1.37\, Y + 0.1276\, Z,$$

$$S = 0.686\, Z,$$

$$\Delta E = [(\Delta C_1)^2 + (\Delta L)^2 + (\Delta C_3)^2]^{\frac{1}{2}}$$

*Friele-MacAdam-Chickering metric

NBS-MCCA COLLABORATIVE REFERENCE PROGRAM

TEST METHOD CODES

FOR PAINT CHIPS AND NEAR WHITE PAPERS

INSTRUMENT CODE PAINT	INSTRUMENT CODE PAPER	INSTRUMENT	COLOR SPACE	DATA CODE
C70AC	C71AC	ACS SPECTRA SENSOR	X Y Z	9014
C70BL	C71BL	B+L 505 SPECTROPHOTOMETER	X Y Z	9014
C70CA	C71CA	CARY 14	X Y Z	9014
C70CB	C71CB	CARY 17	X Y Z	9014
C70CD	C71CD	COLOR EYE SMALL SPHERE	X Y Z	9014
C70CE	C71CE	COLOR EYE SMALL SPHERE	XX'YZ,4V	9016
C70CF	C71CF	COLOR EYE SMALL SPHERE	XYZ,BaSO4	9017
C70CG	C71CG	COLOR EYE SMALL SPHERE	XX'YZ,Ba	9018
C70CH	C71CH	COLOR EYE SMALL SPHERE	XYZ,3V	9011
C70CL	C71CL	COLOR EYE LARGE SPHERE	XX'YZ,4V	9016
C70CM	C71CM	COLOR EYE LARGE SPHERE	XX'YZ,Ba	9018
C70CN	C71CN	COLOR EYE LARGE SPHERE	XYZ,BaSO4	9017
C70DC	C71DC	DIANO CHROMASCAN SPECTROPHOTOMETER	X Y Z	9014
C70DH	C71DH	DIANO MATCH SCAN SPECTROPHOTOMETER	X Y Z	9014
C70DK	C71DK	DIANO/LSCE AUTOMATE	XYZ,BaSO4	9017
C70DL	C71DL	DIANO/LSCE AUTOMATE	XYZ,3V,4F	9019
C70DM	C71DM	DIANO/LSCE AUTOMATE	XX'YZ,4V	9016
C70DS	C71DS	DIANO/SSCE AUTOMATE	XX'YZ,Ba	9018
C70DT	C71DT	DIANO/SSCE AUTOMATE	XYZ,BaSO4	9017
C70GA	C71GA	GARDNER AUTO AC2/AC3	L a b	9013
C70GB	C71GB	GARDNER AUTO AC2/AC3	X Y Z	9014
C70GC	C71GC	GARDNER XL-20/XL-30 SERIES	X Y Z	9014
C70GD	C71GD	GARDNER XL-20/XL-30 SERIES	L a b	9013
C70GE	C71GE	GE/DIANO/HARDY AUTOMATE SPECTRO	X Y Z	9014
C70GK	C71GK	GARDNER XL-70	X Y Z	9014
C70GL	C71GL	GARDNER XL-70	L a b	9013
C70GM	C71GM	GARDNER MULTIPURPOSE REFLECTOMETER	X Y Z	9014
C70GP	C71GP	GARDNER XL-200 SERIES	L a b	9013
C70GX	C71GX	GARDNER XL-10	L a b	9013
C70GY	C71GY	GARDNER XL-10	X Y Z	9014
C70HA	C71HA	HUNTER D25A (DA,D1A,D2A)	L a b	9013
C70HB	C71HB	HUNTER D25A (DA,D1A,D2A)	X Y Z	9014
C70HC	C71HC	HUNTER D25A (DA,D1A,D2A)	RD A B	9012
C70HF	C71HF	HUNTER D25AA	L a b	9013
C70HG	C71HG	HUNTER D25AA	X Y Z	9014
C70HM	C71HM	HUNTER D25M (DM,D1M,D2M)	L a b	9013
C70HN	C71HN	HUNTER D25M (DM,D1M,D2M)	X Y Z	9014
C70HO	C71HO	HUNTER D25M (DM,D1M,D2M)	RD A B	9012
C70HP	C71HP	HUNTER D25P (DP,D1P,D2P)	X Y Z	9014
C70HQ	C71HQ	HUNTER D25P (DP,D1P,D2P)	L a b	9013
C70HR	C71HR	HUNTER D25P (DA,D1A,D2A)	Rd a b	9012
C70HT	C71HT	HUNTER D54 SPECTROPHOTOMETER	X Y Z	9014
C70HU	C71HU	HUNTER D54 SPECTROPHOTOMETER	L a b	9013
C70IC	C71IC	IBM SPECTROPHOTOMETER	L A B	9013
C70IB	C71IB	IBM SPECTROPHOTOMETER	X Y Z	9014
C70KC	C71KC	KCS-18	XX'YZ,4V	9016
C70KD	C71KD	KCS-18	XX'YZ,Ba	9018
C70KS	C71KS	KCS-18	X Y Z	9014
C70KT	C71KT	KCS-40	X Y Z	9014
C70LS	C71LS	LERES TRILAC	X Y Z	9014
C70LT	C71LT	LERES TRILAC	XYZ,3V	9011
C70MD	C71MD	MACBETH MS2000 SPECTROPHOTOMETER	X Y Z	9014
C70ME	C71ME	MACBETH MS2000 SPECTROPHOTOMETER	L a b	9013
C70MG	C71MG	MACBETH MC1010	L a b	9013
C70MB	C71MB	MACBETH MC1010	X Y Z	9014
C70MS	C71MS	MARTIN SWEETS	X Y Z	9014
C70MT	C71MT	MARTIN SWEETS	XX'YZ,Ba	9018
C70ND	C71ND	NEOTEC 220 DU COLOR	R G B	9015
C70NE	C71NE	NEOTEC 220 DU COLOR	X Y Z	9014
C70SA	C71SA	SPECIAL INSTRUMENT - INCLUDED	X Y Z	9014
C70SB	C71SB	SPECIAL INSTRUMENT - INCLUDED	Rd a b	9012
C70SC	C71SC	SPECIAL INSTRUMENT - INCLUDED	L a b	9013
C70SL	C71SL	SPECIAL INSTRUMENT - INCLUDED	R G B	9015
C70SP	C71SP	SPECIAL INSTRUMENT - EXCLUDED	X Y Z	9014
C70SQ	C71SQ	SPECIAL INSTRUMENT - EXCLUDED	Rd a b	9012
C70SR	C71SR	SPECIAL INSTRUMENT - EXCLUDED	L a b	9013
C70SS	C71SS	SPECIAL INSTRUMENT - EXCLUDED	R G B	9015
C70ZD	C71ZD	ZEISS DMC25	X Y Z	9014
C70ZA	C71ZA	ZEISS DMC26	X Y Z	9014
C70ZE	C71ZE	ZEISS ELREPHO	X Y Z	9014
C70ZF	C71ZF	ZEISS ELREPHO	R G B	9015
C70ZB	C71ZB	ZEISS RFC3	X Y Z	9014
C70XX	C71XX	GIVE INSTRUMENT MAKE AND MODEL	NOT SPECIFIED	9020

FORMAT OF COLORIMETRIC (INPUT) DATA

DATA CODE	COLOR SCALE
9011	X,Y,Z 3 FUNCTION VITRELITE CORRECTION
9012	Rd,a,b
9013	L,a,b HUNTER
9014	X,Y,Z
9015	R,G,B
9016	X,X',Y,Z 4 FUNCTION VITRELITE CORRECTION
9017	X,Y,Z, BaSO4 CORRECTION
9018	X,X',Y,Z BaSO4 CORRECTION
9019	X,Y,Z 4 FUNCTION VITRELITE CORRECTION
9020	(NON-STD. INST. SCALE SPECIFIED WITH DATA)

Notes on Specific Laboratory Results for Paint Chips

C223 - Submitted insufficient data to be analyzed in this report

C253, C655 - Data included in body of report, but received too late for checking and therefore not included in statistical computation

C514A, C514B, C612 C662, C717A, C717B C720A, C720B - Used illuminant D65

C705, C707, C750 - Apparent reporting or measurement problem on all five samples

C708B - Used illuminant A

C725 - Reported extreme values compared to other labs on sample D19

C742 - Apparent reporting or measurement problem on samples D19 and D20

MCCA COLLABORATIVE REFERENCE PROGRAM
X, Y, Z SPACE ANALYSIS, NORMAL DATA
COLOR • COLOR DIFFERENCE
FOR PAINT CHIPS

LAB CODE	F	SAMPLE D17 MEAN X	MEAN Y	MEAN Z	SAMPLE D18 MEAN X	MEAN Y	MEAN Z	DIFFERENCE D18 - D17 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C157	0	39.67	30.78	28.01	39.11	30.03	27.80	-.56	-.75	-.21	3.31	70GE	C157
C162	0	41.37*	32.00*	27.51	40.87*	31.30*	27.44	-.49	-.70	-.07	3.21	70DC	C162
C251	0	39.68	29.80	26.81	39.02	29.00	26.57	-.66	-.80	-.24	3.30	70ZE	C251
C253	#	38.48	29.40	26.85	37.90	28.70	26.77	-.58	-.70	-.09	2.77	70SA	C253
C278	0	38.40	30.35	26.10	37.60	29.50	25.85	-.80	-.85	-.25	2.60	70NE	C278
C407	0	40.09	31.15	28.36	39.54	30.43	28.24	-.55	-.72	-.12	3.00	70BL	C407
C414	0	39.28	30.18	26.44	38.85	29.58	26.41	-.43	-.60	-.03	2.77	70MD	C414
C416A	0	36.61X	29.29	27.36	35.89X	28.52	27.23	-.72	-.77	-.13	2.40	70IE	C416A
C416B	0	35.89X	28.77*	27.60	35.17X	27.95*	27.40	-.72	-.82	-.20	2.85	70GE	C416B
C417B	0	38.60	29.65	26.84	37.99	28.89	26.70	-.61	-.76	-.14	3.12	70BN	C417B
C418	0	38.66	30.04	27.17	38.13	29.35	27.02	-.54	-.69	-.15	2.88	70CE	C418
C422	0	38.06	28.98	26.25	37.55	28.32	26.19	-.51	-.65	-.06	2.84	70GC	C422
C424	0	39.38	30.63	28.14	38.84	29.92	28.03	-.54	-.72	-.11	3.04	70CA	C424
C428	0	39.46	30.25	27.25	38.89	29.55	27.20	-.57	-.70	-.05	2.76	70BE	C428
C443	0	40.14	30.94	27.55	40.01	30.55	27.80	-.13 X	-.38 X	.25 *	2.73	70CM	C443
C444	0	39.43	30.48	27.66	39.24	30.11	27.90	-.18 X	-.37 X	.24 *	2.14*	70GE	C444
C446	0	39.00	30.07	28.04	38.83	29.70	28.19	-.18 X	-.37 X	.15	2.23*	70GE	C446
C451	0	40.46	31.00	26.67	40.11	30.49	26.79	-.34 *	-.52 *	.12	2.48	70AC	C451
C453	0	40.03	30.66	27.21	39.72	30.18	27.34	-.30 *	-.48 *	.13	2.47	70BT	C453
C459	0	38.76	29.96	27.33	38.25	29.26	27.23	-.51	-.70	-.11	3.20	70GE	C459
C460	0	39.05	30.13	27.05	38.22	29.15	26.66	-.83	-.98 *	-.39	3.74	70GE	C460
C462A	0	39.05	30.05	27.10	38.55	29.45	27.10	-.50	-.60	.00	2.30	70BE	C462A
C463	0	40.00	30.66	27.11	39.50	30.04	27.13	-.50	-.62	.02	2.46	70DC	C463
C467A	0	38.91	30.16	29.39*	38.41	29.53	29.34*	-.49	-.63	-.05	2.55	70GE	C467A
C467B	0	38.86	29.88	26.90	38.38	29.26	26.92	-.48	-.63	.02	2.66	70BN	C467B
C469	0	39.81	30.84	28.24	39.34	30.17	28.18	-.47	-.67	-.06	3.11	70GE	C469
C470	0	40.03	31.04	28.01	39.51	30.32	27.91	-.52	-.72	-.11	3.23	70DB	C470
C472	0	40.95*	31.97*	28.16	40.47*	31.26*	28.08	-.48	-.71	-.08	3.38	70ZD	C472
C473	0	39.88	30.65	27.09	39.32	29.94	26.99	-.57	-.71	-.10	2.83	70DB	C473
C474	0	39.08	30.33	28.24	38.42	29.52	27.99	-.66	-.81	-.25	3.17	70GE	C474
C476	0	39.07	29.79	26.64	38.44	29.02	26.50	-.63	-.78	-.14	3.15	70SA	C476
C479B	0	39.74	30.61	27.69	39.12	29.84	27.54	-.62	-.77	-.15	3.12	70CE	C479B
C480	0	37.78	29.08	25.35	37.14	28.33	25.19	-.64	-.75	-.16	2.87	70BE	C480
C481	0	38.70	29.95	26.90	38.05	29.20	26.80	-.65	-.75	-.10	2.70	70BE	C481
C482	0	38.41	29.31	26.30	37.79	28.51	26.09	-.63	-.80	-.20	3.50	70GC	C482
C483	0	38.69	29.20	26.69	38.12	28.50	26.57	-.57	-.70	-.12	2.91	70ZF	C483
C499C	0	39.17	30.14	29.75*	38.65	29.48	29.59*	-.53	-.66	-.16	2.69	70BL	C499C
C503	0	39.35	30.41	28.11	38.81	29.70	27.94	-.55	-.71	-.17	3.08	70GE	C503
C508	0	39.88	30.86	28.31	39.32	30.12	28.10	-.56	-.74	-.21	3.26	70GE	C508
C511	0	39.63	30.50	27.07	39.06	29.76	26.94	-.57	-.74	-.13	3.15	70DB	C511
C512	0	40.46	31.13	26.61	39.88	30.38	26.50	-.58	-.75	-.11	3.13	70AC	C512
C514B	*	38.77	30.56	26.20	38.21	29.82	26.05	-.57	-.73	-.15	3.06	70SF	C514B
C521A	0	39.69	30.51	28.11	39.02	29.73	27.89	-.66	-.78	-.22	2.95	70CA	C521A
C521B	0	39.73	30.54	27.32	38.65	29.39	26.71	-1.09 X	-1.15 X	-.61 X	3.78	70SA	C521B
C526	0	36.14X	29.13	27.41	35.41X	28.30	27.13	-.74	-.83	-.28	2.78	70DB	C526
C528	0	39.85	30.74	27.00	39.14	29.87	26.63	-.71	-.88	-.38	3.60	70MD	C528
C529	0	38.60	30.12	24.79*	37.97	29.33	24.59*	-.64	-.79	-.20	3.25	70DB	C529
C532	0	40.21	31.57	30.51X	39.61	30.79	30.28X	-.60	-.78	-.23	3.19	70GE	C532
C534	0	40.47	31.05	26.94	39.89	30.33	26.84	-.57	-.72	-.10	2.89	70MD	C534
C536	0	38.21	30.40	24.79*	37.45	29.56	24.51*	-.77	-.84	-.29	2.67	70AC	C536
C540	0	39.67	30.79	28.63	38.91	29.89	28.21	-.76	-.90	-.42	3.48	70GE	C540
C545	0	37.91	29.33	26.59	37.22	28.48	26.25	-.68	-.85	-.33	3.53	70GE	C545
C549	0	40.16	30.82	26.94	39.84	30.33	27.15	-.32 *	-.49 *	.21 *	2.41	70DB	C549
C552	0	38.61	29.74	26.96	38.04	29.04	26.87	-.57	-.70	-.09	2.79	70BN	C552
C612	*	36.22X	28.83	24.63*	35.60X	28.14	24.53*	-.62	-.69	-.10	2.29	70SF	C612
C613	0	40.43	31.42	25.90	39.58	30.40	25.36	-.86 *	-1.02 *	-.54 *	4.05*	70MD	C613
C627	0	39.55	30.58	27.59	38.87	29.74	27.37	-.68	-.84	-.21	3.31	70ZE	C627
C630	0	39.17	30.17	27.08	38.59	29.43	26.93	-.58	-.74	-.15	3.10	70KS	C630
C631	0	39.94	30.71	26.83	39.39	30.02	26.76	-.55	-.69	-.08	2.78	70AC	C631
C632	0	40.06	30.76	26.73	39.71	30.28	26.95	-.35 *	-.48 *	.22 *	2.17*	70AC	C632
C638	0	38.70	29.20	27.10	37.90	28.30	26.85	-.80	-.90	-.25	3.31	70SA	C638
C639	0	40.16	31.01	26.75	39.51	30.22	26.59	-.66	-.79	-.16	3.01	70DB	C639
C644	0	39.60	30.33	26.58	38.82	29.43	26.23	-.78	-.90	-.35	3.43	70MD	C644
C645	0	40.21	30.85	26.93	39.53	30.04	26.76	-.68	-.81	-.17	3.06	70AC	C645
C656	0	39.18	30.20	26.72	38.77	29.57	26.70	-.41	-.63	-.02	3.20	70SA	C656

MCCA COLLABORATIVE REFERENCE PROGRAM
X, Y, Z SPACE ANALYSIS, NORMAL DATA
COLOR + COLOR DIFFERENCE
FOR PAINT CHIPS

LAB CODE	F	SAMPLE D17 MEAN X	SAMPLE D17 MEAN Y	SAMPLE D17 MEAN Z	SAMPLE D18 MEAN X	SAMPLE D18 MEAN Y	SAMPLE D18 MEAN Z	DIFFERENCE D18 - D17 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C657		38.75	30.37	24.63*	38.16	29.64	24.51*	-.59	-.73	-.13	2.87	70AC	C657
C662		38.35	29.89	24.82*	37.79	29.19	24.73*	-.55	-.70	-.10	2.82	70SP	C662
C672	O	38.70	29.70	26.70	38.00	28.85	26.50	-.70	-.85	-.20	3.39	70GC	C672
C675	O	39.80	30.61	26.84	39.12	29.80	26.60	-.68	-.81	-.24	3.15	70AC	C675
C683	O	37.79	28.47*	25.12	37.05*	27.63*	24.92	-.73	-.84	-.20	3.23	70GC	C683
C691	O	38.68	29.17	26.61	37.98	28.42	26.42	-.70	-.75	-.18	2.63	70ZE	C691
C700	O	39.46	30.37	26.85	38.85	29.61	26.66	-.61	-.76	-.19	3.10	70DB	C700
C705	#	30.13X	.40X	.31X	29.29X	.40X	.31X	-.84	.00 X	.00	86X	70BF	C705
C707	#	27.92X	20.97X	18.46X	27.53X	20.49X	18.38X	-.39	-.48 *	-.08	2.54	70SA	C707
C708A	O	42.26X	32.87X	27.44	41.77X	32.19X	27.43	-.49	-.68	-.01	2.89	70BT	C708A
C708B	+	.44X	.79X	.92X	-.44X	.80X	.92X	.00 X	.01 X	.00	67X	70SS	C708B
C709	O	39.15	30.01	26.77	38.52	29.25	26.63	-.63	-.76	-.14	3.01	70KS	C709
C716	O	37.81	29.70	26.80	37.26	29.00	26.81	-.55	-.70	.01	2.83	70ZE	C716
C717A	+	39.06	30.52	24.87*	38.56	29.85	24.79	-.50	-.67	-.08	2.96	70SP	C717A
C717B	+	39.03	30.51	25.10	38.41	29.73	24.91	-.63	-.78	-.19	3.14	70SP	C717B
C718A	O	39.16	30.71	24.79*	38.42	29.85	24.55*	-.74	-.86	-.24	3.18	70AC	C718A
C718B	O	38.96	30.51	24.67*	38.26	29.67	24.46*	-.70	-.84	-.21	3.20	70AC	C718B
C719C	O	37.70*	28.64*	26.26	37.11	27.92*	26.15	-.60	-.73	-.11	2.97	70KC	C719C
C720A	+	38.74	30.23	25.01	37.98	29.33	24.69*	-.76	-.89	-.32	3.38	70SP	C720A
C720B	+	38.72	30.22	24.94*	37.98	29.34	24.64*	-.74	-.88	-.30	3.41	70SP	C720B
C723	O	39.59	30.45	26.46	38.86	29.58	26.18	-.73	-.87	-.28	3.37	70MD	C723
C724	O	39.42	30.52	27.93	38.71	29.66	27.64	-.70	-.86	-.29	3.40	70ZA	C724
C725	O	38.57	29.82	26.31	38.09	29.11	26.58	-.48	-.71	.27 *	3.40	70KS	C725
C726	O	41.22*	31.72*	27.99	40.61*	30.92	27.87	-.61	-.80	-.13	3.31	70SA	C726
C727A	+	38.57	30.08	24.75*	38.16	29.51	24.81	-.41	-.58	.06	2.62	70SP	C727A
C727B	+	38.56	30.09	24.81*	38.08	29.44	24.79	-.48	-.65	-.03	2.87	70SP	C727B
C741	O	39.29	30.12	27.32	38.77	29.43	28.28	-.53	-.69	.96 X	4.04*	70CB	C741
C742	#	39.34	30.47	24.63*	38.86	29.84	24.62*	-.48	-.63	-.01	2.68	70DB	C742
C748	O	39.01	30.01	27.19	38.39	29.27	27.07	-.63	-.74	-.12	2.79	70BE	C748
C749	O	39.06	30.59	24.77*	38.20	29.62	24.38*	-.86 *	-.97 *	-.39	3.44	70AC	C749
C752A	O	39.18	30.37	27.33	38.52	29.55	27.06	-.67	-.82	-.27	3.30	70DB	C752A
C752B	O	38.82	29.90	26.86	38.14	29.12	26.70	-.68	-.78	-.16	2.82	70BN	C752B
GRAND MEANS		39.33	30.29	27.01	38.74	29.54	26.88	-.61	-.75	-.13	3.03		
SD OF MEANS		.78	.71	.99	.82	.73	1.03	.12	.10	.15	.39		
INCLUDED LABS FOR THIS MEAN		79	82	82	79	82	82	79	79	81	83		

X, Y, Z SPACE ANALYSIS, NORMAL DATA
COLOR + COLOR DIFFERENCE
FOR PAINT CHIPS

LAB CODE	F	SAMPLE D19 MEAN X	SAMPLE D19 MEAN Y	SAMPLE D19 MEAN Z	SAMPLE D20 MEAN X	SAMPLE D20 MEAN Y	SAMPLE D20 MEAN Z	DIFFERENCE D20 - D19 ΔX	DIFFERENCE D20 - D19 ΔY	DIFFERENCE D20 - D19 ΔZ	ΔE	INST CODE	LAB
C157	0	7.51	7.68	9.68	6.65	6.77	8.57	-.86	-.91	-1.11	4.36	70GE	C157
C162	0	7.89*	8.03*	9.74	7.18*	7.31*	8.88	-.70	-.72	-.86	3.34	70DC	C162
C251	0	7.23	7.30	9.09	6.43	6.50	8.03	-.80	-.80	-1.06	3.95	70ZE	C251
C253	0	6.91	7.13	8.72	6.15	6.36	7.76	-.76	-.78	-.96	3.86	70SA	C253
C278	0	7.05	7.35	8.85	6.30	6.55	7.85	-.75	-.80	-1.00	3.95	70NE	C278
C407	0	7.59	7.70	9.51	6.96	7.06	8.74	-.63	-.64	-.77	3.02	70EI	C407
C414	0	6.94	7.08	8.63	6.32	6.45	7.86	-.62	-.64	-.77	3.17	70MD	C414
C416A	0	7.21	7.36	8.85	6.44	6.57	7.89	-.78	-.79	-.96	3.86	70IE	C416A
C416B	0	6.74	6.89*	8.51	6.08	6.21	7.67	-.66	-.68	-.84	3.45	70GE	C416B
C417B	0	7.04	7.13	8.94	6.36	6.44	8.08	-.69	-.69	-.87	3.43	70BN	C417B
C418	0	7.67	7.79	9.60	6.86	6.95	8.54	-.81	-.83	-1.06	3.97	70CE	C418
C422	0	6.87	7.01	8.52	6.20	6.31	7.68	-.67	-.70	-.84	3.52	70GC	C422
C424	0	7.49	7.63	9.43	6.87	6.99	8.66	-.62	-.64	-.77	3.04	70CA	C424
C428	0	7.08	7.21	8.88	6.55	6.67	8.24	-.53 *	-.54 *	-.64 *	2.67	70BE	C428
C443	0	7.49	7.58	9.49	6.73	6.79	8.52	-.76	-.79	-.97	3.84	70CM	C443
C444	0	7.49	7.62	9.48	6.71	6.84	8.48	-.78	-.79	-1.00	3.76	70GE	C444
C446	0	7.42	7.55	9.34	6.68	6.80	8.39	-.74	-.75	-.95	3.64	70GE	C446
C451	0	7.31	7.45	9.12	6.64	6.77	8.28	-.67	-.68	-.85	3.32	70AC	C451
C453	0	7.44	7.58	9.41	6.61	6.73	8.36	-.83	-.85	-1.05	4.08	70BT	C453
C459	0	7.36	7.49	9.27	6.49	6.60	8.17	-.87	-.89	-1.10	4.29	70GE	C459
C460	0	6.95	7.09	8.81	6.05	6.17	7.64	-.90	-.92	-1.17	4.59	70GE	C460
C462A	0	7.15	7.35	9.05	6.35	6.50	8.05	-.80	-.85	-1.00	4.17	70BE	C462A
C463	0	7.40	7.54	9.25	6.59	6.71	8.22	-.81	-.83	-1.03	4.01	70DC	C463
C467A	0	7.60	7.76	9.64	6.81	6.95	8.63	-.79	-.81	-1.01	3.86	70GE	C467A
C467B	0	7.10	7.24	8.97	6.32	6.44	7.97	-.78	-.80	-1.00	3.95	70BN	C467B
C469	0	7.68	7.81	9.80	6.85	6.96	8.74	-.83	-.85	-1.06	3.99	70GE	C469
C470	0	7.41	7.54	9.37	6.59	6.70	8.33	-.82	-.83	-1.04	4.02	70DB	C470
C472	0	7.56	7.68	9.47	6.82	6.94	8.50	-.74	-.75	-.97	3.57	70ZD	C472
C473	0	7.32	7.44	9.19	6.55	6.66	8.21	-.77	-.78	-.98	3.79	70DB	C473
C474	0	7.74	7.89	9.95*	6.94	7.07	8.96*	-.80	-.82	-.99	3.84	70GE	C474
C476	0	7.13	7.24	9.34	6.21	6.30	8.18	-.92 *	-.95	-1.17	4.65	70SA	C476
C479B	0	7.32	7.44	9.25	6.62	6.74	8.31	-.70	-.70	-.94	3.42	70CE	C479B
C480	0	7.21	7.38	8.99	6.41	6.55	7.98	-.81	-.83	-1.00	4.07	70BE	C480
C481	0	7.35	7.25	9.10	6.40	6.30	7.90	-.95 *	-.95	-1.20 *	4.70*	70BE	C481
C482	0	6.82	6.97	8.51	6.00*	6.12*	7.46	-.82	-.85	-1.05	4.30	70GC	C482
C483	0	7.60	7.50	9.45	6.76	6.60	8.39	-.84	-.90	-1.06	4.57	70ZF	C483
C499C	0	7.89*	8.01*	9.95*	6.86	6.98	8.64	-1.03 X	-1.03 *	-1.31 *	4.80*	70BI	C499C
C503	0	7.34	7.46	9.33	6.69	6.79	8.49	-.64	-.66	-.84	3.23	70GE	C503
C508	0	7.21	7.35	9.17	6.65	6.77	8.47	-.56	-.58	-.70	2.83	70GE	C508
C511	0	7.35	7.48	9.24	6.71	6.83	8.42	-.63	-.65	-.82	3.15	70DB	C511
C512	0	7.30	7.45	9.10	6.68	6.81	8.30	-.62	-.63	-.79	3.09	70AC	C512
C514B	+	7.02	7.38	8.47	6.42	6.75	7.72	-.60	-.63	-.75	3.05	70SF	C514B
C521A	0	7.44	7.55	9.46	6.74	6.84	8.54	-.70	-.70	-.92	3.40	70CA	C521A
C521B	0	6.87	7.01	8.81	6.41	6.52	8.25	-.46 *	-.49 *	-.57 *	2.47*	70SA	C521B
C526	0	7.22	7.37	9.02	6.62	6.76	8.26	-.60	-.61	-.76	3.01	70DB	C526
C528	0	7.19	7.34	9.00	6.50	6.63	8.14	-.69	-.71	-.86	3.49	70MD	C528
C529	0	7.05	7.36	8.42	6.37	6.64	7.60	-.68	-.71	-.82	3.49	70DB	C529
C532	0	7.08	7.23	8.92	6.42	6.55	8.11	-.66	-.68	-.81	3.35	70GE	C532
C534	0	7.31	7.29	8.92	6.59	6.53	7.97	-.73	-.77	-.95	3.92	70MD	C534
C536	0	7.07	7.46	8.32	6.37	6.72	7.48	-.71	-.74	-.84	3.60	70AC	C536
C540	0	8.03*	8.19X	10.08*	7.20*	7.34*	9.04*	-.83	-.84	-1.04	3.88	70GE	C540
C545	0	6.80	6.94	8.66	6.23	6.35	7.90	-.57	-.59	-.75	2.99	70GE	C545
C549	0	7.21	7.33	9.06	6.47	6.57	8.13	-.74	-.76	-.93	3.72	70DB	C549
C552	0	7.02	7.15	8.66	6.30	6.41	7.95	-.72	-.74	-.91	3.67	70BN	C552
C612	+	6.37X	6.73*	7.63X	5.63X	5.95*	6.78X	-.74	-.79	-.85	4.03	70SF	C612
C613	0	6.33X	7.13	6.83X	5.57X	6.34	5.87X	-.75	-.79	-.96	4.14	70MD	C613
C627	0	7.47	7.61	9.45	6.65	6.77	8.40	-.82	-.84	-1.05	4.03	70ZE	C627
C630	0	7.45	7.58	9.42	6.71	6.82	8.50	-.74	-.76	-.93	3.65	70BS	C630
C631	0	7.31	7.44	9.15	6.49	6.61	8.10	-.82	-.83	-1.04	4.03	70AC	C631
C632	0	7.37	7.51	9.23	6.67	6.80	8.35	-.70	-.71	-.88	3.45	70AC	C632
C638	0	7.20	7.40	9.00	6.50	6.60	8.10	-.70	-.80	-.90	4.22	70SA	C638
C639	0	7.29	7.42	9.17	6.66	6.77	8.38	-.63	-.65	-.79	3.16	70DB	C639
C644	0	6.88	6.94	8.40	6.38	6.43	7.77	-.50 *	-.51 *	-.63 *	2.59*	70MD	C644
C645	0	7.30	7.44	9.11	6.65	6.76	8.28	-.66	-.68	-.83	3.28	70AC	C645
C656	0	6.86	6.99	8.60	6.12	6.23	7.65	-.74	-.76	-.95	3.83	70SA	C656

X, Y, Z SPACE ANALYSIS, NORMAL DATA
COLOR - COLOR DIFFERENCE
FOR PAINT CHIPS

LAB CODE	F	SAMPLE D19 MEAN X	MEAN Y	MEAN Z	SAMPLE D20 MEAN X	MEAN Y	MEAN Z	DIFFERENCE D20 - D19 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C6	O	7.13	7.50	8.47	6.32	6.64	7.49	-.81	-.86	-.98	4.15	70AC	C657
C	•	6.99	7.30	8.36	6.32	6.59	7.56	-.67	-.71	-.80	3.45	70SF	C662
C 72	O	6.90	7.05	8.60	6.20	6.30	7.70	-.70	-.75	-.90	3.83	70GC	C672
C675	O	7.25	7.38	9.04	6.62	6.74	8.25	-.63	-.64	-.79	3.12	70AC	C675
C683	O	6.65*	6.97	8.52	5.97*	6.27	7.65	-.68	-.70	-.87	3.55	70GC	C683
C691	O	7.23	7.30	8.30	6.61	6.70	7.56	-.62	-.61	-.74	3.01	70ZE	C691
C700	O	7.14	7.27	8.95	6.55	6.66	8.21	-.59	-.61	-.74	3.00	70DB	C700
C705	#	7.20	.31X	.31X	6.54	.31X	.31X	-.66	.00 X	.00 X	3.24	70HF	C705
C707	#	4.99X	5.07X	6.39X	4.54X	4.61X	5.82X	-.45 *	-.46 *	-.57 *	2.81	70SA	C707
C708A	O	7.60	7.75	9.52	6.84	6.97	8.55	-.76	-.79	-.97	3.72	70HT	C708A
C708B	•	1.20X	1.22X	1.43X	1.25X	1.27X	1.48X	.05 X	.05 X	.05 X	.90X	70SS	C708B
C709	O	7.60	7.73	9.50	6.84	6.95	8.54	-.76	-.78	-.97	3.68	70KS	C709
C716	O	7.33	7.40	9.21	6.55	6.60	8.27	-.78	-.80	-.94	3.89	70ZE	C716
C717A	•	7.18	7.50	8.57	6.39	6.67	7.61	-.79	-.82	-.96	3.98	70SF	C717A
C717B	•	7.25	7.57	8.69	6.46	6.74	7.73	-.79	-.82	-.95	3.96	70SF	C717B
C718A	O	7.13	7.49	8.44	6.42	6.74	7.59	-.71	-.75	-.85	3.62	70AC	C718A
C718B	O	6.98	7.34	8.27	6.33	6.64	7.50	-.66	-.70	-.77	3.42	70AC	C718B
C719C	O	7.10	7.21	8.96	6.40	6.50	8.07	-.70	-.71	-.89	3.51	70KC	C719C
C720A	•	7.04	7.36	8.42	6.49	6.78	7.78	-.55	-.58	-.64 *	2.83	70SP	C720A
C720B	•	7.01	7.33	8.40	6.47	6.76	7.77	-.54	-.57	-.63 *	2.78	70SF	C720B
C723	O	7.07	7.21	8.87	6.26	6.38	7.84	-.82	-.83	-1.03	4.10	70MD	C723
C724	O	7.33	7.45	9.20	6.51	6.61	8.17	-.82	-.84	-1.04	4.07	70ZA	C724
C725	X	8.34X	7.46	9.34	6.52	6.66	8.22	-1.82 X	-.81	-1.12	23.13X	70KS	C725
C726	O	7.54	7.66	9.57	6.95	7.06	8.81	-.59	-.59	-.75	2.84	70SA	C726
C727A	•	7.12	7.44	8.53	6.33	6.61	7.57	-.79	-.83	-.96	4.02	70SF	C727A
C727B	•	7.12	7.44	8.54	6.41	6.69	7.66	-.71	-.75	-.88	3.67	70SF	C727B
C741	O	7.56	7.67	9.74	6.81	6.91	8.76	-.75	-.76	-.98	3.65	70CE	C741
C742	#	105.19X	110.33X	120.45X	94.16X	98.69X	107.65X	-11.03 X	-11.64 X	-12.80 X	9.38X	70DB	C742
C748	O	7.22	7.39	9.14	6.60	6.76	8.35	-.63	-.63	-.79	3.09	70HB	C748
C749	O	7.30	7.67	8.67	6.49	6.82	7.70	-.82	-.86	-.97	4.07	70AC	C749
C752A	O	7.20	7.33	9.05	6.51	6.62	8.18	-.70	-.71	-.87	3.47	70DB	C752A
C752B	O	7.01	7.14	8.83	6.26	6.37	7.88	-.75	-.76	-.95	3.80	70HN	C752B
GRAND MEANS		7.27	7.41	9.10	6.54	6.67	8.18	-.72	-.75	-.92	3.66		
SD OF MEANS		.27	.25	.41	.25	.25	.38	.10	.10	.13	.50		
INCLUDED LABS FOR THIS MEAN		81	81	81	81	82	81	81	82	82	82		

L, a, b SPACE ANALYSIS, NORMAL DATA
COLOR + COLOR DIFFERENCE
FOR PAINT CHIPS

LAB		SAMPLE D17			SAMPLE D18			DIFFERENCE D18 - D17				INST	
CODE	F	MEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN B	ΔL	ΔA	ΔB	ΔE	CODE	LAB
C121	O	53.65	31.90	10.80X	52.85*	32.70	10.20X	-.80 *	.80	-.60 *	1.28	70BA	C121
C148	O	54.90	31.75	9.00	54.20	32.45	8.25	-.70	.70	-.75	1.24	70BF	C148
C152	O	55.25	30.75	9.10	54.65	31.45	8.40	-.60	.70	-.70	1.16	70BA	C152
C166	O	55.00	30.95	9.05	54.30	31.65	8.35	-.70	.70	-.70	1.21	70BA	C166
C183	O	54.40	31.65	9.20	53.70	32.35	8.50	-.70	.70	-.70	1.21	70BA	C183
C241	O	55.25	30.90	9.40	54.55	31.55	8.75	-.70	.65	-.65	1.16	70BF	C241
C255	O	55.20	30.35	9.25	54.45	31.05	8.40	-.75	.70	-.85 *	1.33*	70BA	C255
C256A	O	54.66	31.14	9.02	54.02	31.89	8.33	-.64	.74	-.69	1.20	70SC	C256A
C256B	O	55.49	31.47	10.15*	54.79	32.34	9.53*	-.70	.87	-.62	1.28	70BU	C256B
C288	O	54.70	31.40	9.20	54.00	32.10	8.50	-.70	.70	-.70	1.21	70BM	C288
C291	O	54.70	31.25	8.65	54.00	31.95	7.95	-.70	.70	-.70	1.21	70BA	C291
C317	O	54.30	31.10	8.90	53.70	31.80	8.10	-.60	.70	-.80	1.22	70BM	C317
C325	O	54.59	30.59	8.39	53.85	31.27	7.71	-.74	.67	-.68	1.21	70BC	C325
C356	O	53.49*	31.26	8.29	52.86*	31.93	7.59	-.63	.67	-.69	1.15	70DC	C356
C380	O	55.00	31.95	9.20	54.35	32.85	8.50	-.65	.90 *	-.70	1.31	70BA	C380
C382	O	55.00	30.70	9.20	54.25	31.45	8.55	-.75	.75	-.65	1.24	70BA	C382
C390	O	54.90	31.85	8.70	54.30	32.60	7.95	-.60	.75	-.75	1.22	70BF	C390
C402	O	54.71	30.99	8.77	54.13	31.69	8.03	-.58	.70	-.74	1.18	70BA	C402
C420A	O	54.50	31.50	8.70	53.80	32.25	8.00	-.70	.75	-.70	1.24	70BF	C420A
C420B	O	54.45	31.65	8.80	53.90	32.25	8.00	-.55 *	.60	-.80	1.14	70BF	C420B
C427	O	55.10	31.60	9.30	54.40	32.45	8.60	-.70	.85	-.70	1.30	70BA	C427
C437	O	54.35	32.69	8.88	53.72	33.44	8.20	-.63	.75	-.68	1.20	70GD	C437
C440	O	54.98	31.44	9.14	54.32	32.10	8.43	-.66	.66	-.71	1.17	70BA	C440
C442	O	54.80	30.80	9.30	54.10	31.50	8.60	-.70	.70	-.70	1.21	70BM	C442
C454	O	53.99	30.78	7.97*	53.27	31.36	7.25*	-.72	.58	-.72	1.17	70BA	C454
C458	O	54.87	31.43	9.39	54.24	32.13	8.66	-.63	.70	-.73	1.19	70BM	C458
C475	O	54.34	31.82	8.47	53.77	32.60	7.71	-.57	.78	-.76	1.23	70BA	C475
C477	O	54.46	32.46	8.97	53.81	33.15	8.26	-.65	.69	-.71	1.18	70BA	C477
C494	O	55.35	31.20	9.55	54.70	31.80	8.80	-.65	.60	-.75	1.16	70BA	C494
C496B	O	53.85	32.00	10.55X	53.20	32.75	9.80*	-.65	.75	-.75	1.24	70GF	C496B
C499A	X	54.65	32.20	8.55	54.10	32.05	7.85	-.55 *	-.15 X	-.70	.90X	70BA	C499A
C499B	O	54.80	31.15	8.90	54.10	31.85	8.15	-.70	.70	-.75	1.24	70BA	C499B
C506	O	55.00	31.55	8.90	54.30	32.20	8.25	-.70	.65	-.65	1.16	70BA	C506
C514A	+	54.98	32.80	9.86	54.31	33.63	9.13	-.67	.83	-.73	1.30	70SB	C514A
C517	O	55.00	30.20	9.40	54.30	31.00	8.70	-.70	.80	-.70	1.27	70BC	C517
C538	X	56.00*	34.20*	8.40	55.20*	35.10X	7.70	-.80	.90 *	-.70	1.39X	70GX	C538
C541	X	53.90	31.85	8.05*	53.05	32.75	7.30	-.85 *	.90 *	-.75	1.45X	70GF	C541
C546A	O	54.20	31.40	8.60	53.50	32.10	7.90	-.70	.70	-.70	1.21	70BM	C546A
C546B	O	53.90	32.00	9.00	53.20	32.60	8.30	-.70	.60	-.70	1.16	70BC	C546B
C547	O	53.27*	33.36*	9.17	52.73*	34.19*	8.46	-.54 *	.83	-.72	1.22	70BC	C547
C574	O	54.90	33.80*	9.40	54.20	34.50*	8.70	-.70	.70	-.70	1.21	70BC	C574
C576	O	54.53	31.22	8.89	53.85	32.02	8.13	-.68	.80	-.76	1.30	70BC	C576
C600	O	54.40	33.90*	8.60	53.80	34.75*	7.85	-.60	.85	-.75	1.28	70GD	C600
C619	O	54.10	33.30*	9.00	53.40	34.00	8.40	-.70	.70	-.60 *	1.16	70BC	C619
C620	O	53.71	31.64	10.21*	53.02	32.51	9.54*	-.69	.87	-.67	1.30	70MG	C620
C633	X	54.80	31.02	8.76	54.38	31.60	8.01	-.42 X	.58	-.75	1.05X	70BA	C633
C655	O	55.55	32.04	10.30*	54.83	32.85	9.64*	-.72	.80	-.66	1.27	70BU	C655
C677	O	55.40	32.09	8.80	54.62	32.79	8.09	-.78	.74	-.72	1.29	70SC	C677
C690	X	55.15	30.09	8.60	53.80	31.65	8.10	-1.35 X	1.56 X	-.50 X	2.13X	70BM	C690
C719A	O	54.95	30.00	8.90	54.20	30.80	8.30	-.75	.80	-.60 *	1.25	70BA	C719A
C719B	O	55.05	30.85	8.95	54.30	31.55	8.25	-.75	.70	-.70	1.24	70BA	C719B
C750	*	59.36X	29.72*	2.68X	58.57X	30.47	1.85X	-.79	.74	-.84 *	1.37*	70DC	C750
GRAND MEANS													
		54.64	31.55	9.05	53.97	32.28	8.37	-.68	.73	-.71	1.22		
SD OF MEANS													
		.54	.86	.46	.53	.88	.52	.06	.08	.05	.05		
INCLUDED LABS FOR THIS MEAN													
		45	45	43	45	45	44	45	45	45	45		

L, a, b SPACE ANALYSIS, NORMAL DATA
COLOR + COLOR DIFFERENCE
FOR PAINT CHIPS

LAB CODE	F	SAMPLE D19 MEAN L	MEAN A	MEAN B	SAMPLE D20 MEAN L	MEAN A	MEAN B	DIFFERENCE D20 - D19 ΔL	ΔA	ΔB	ΔE	INST CODE	LAB
C121	0	26.45	.90*	1.10X	25.10	1.20X	1.80X	-1.35	.30 X	.70 X	1.55	70BA	C121
C148	0	27.05	-.00	-.90	25.80	-.00	-.80	-1.25	-.00	.10	1.25	70BF	C148
C152	0	25.85X	.10	-.70	27.60X	.10	-.70	1.75 X	.00	-.00	1.75	70BA	C152
C166	0	27.20	-.10	-.90	25.80	-.05	-.80	-1.40	.05	.10	1.40	70BA	C166
C183	0	27.05	-.50	-.90	25.55	-.50*	-.90	-1.50	.00	.00	1.50	70BA	C183
C241	0	27.10	.25	-.70	25.45	.30	-.60	-1.65	.05	.10	1.65	70BF	C241
C255	0	27.10	.10	-.85	25.50	.10	-.80	-1.60	-.00	.05	1.60	70BA	C255
C256A	0	26.71	.08	-.95	25.07	.11	-.87	-1.65	.04	.08	1.65	70SC	C256A
C256B	0	27.30	.05	-.86	26.03	.05	-.83	-1.27	.00	.02	1.27	70BT	C256B
C288	0	26.50	.30	-.80	25.10	.40	-.80	-1.40	.10 *	-.00	1.40	70BM	C288
C291	0	26.95	.55	-.80	25.70	.10	-.80	-1.25	-.45 X	.00	1.33	70BA	C291
C317	0	26.60	.10	-.80	25.30	.10	-.80	-1.30	-.00	-.00	1.30	70BM	C317
C325	0	26.74	.30	-.87	25.59	.30	-.87	-1.15	.00	.00	1.15	70BC	C325
C356	0	26.02X	.05	-1.09	24.73*	.07	-1.04	-1.29	.02	.04	1.29	70IC	C356
C380	0	27.05	-.00	-.85	25.75	-.00	-.80	-1.30	-.00	.05	1.30	70BA	C380
C382	0	27.05	-.00	-.65	25.90	-.05	-.60	-1.15	-.05	.05	1.15	70BA	C382
C390	0	27.50	.60	-1.10	26.20	.65*	-1.10	-1.30	.05	.00	1.30	70BF	C390
C402	0	27.19	-.00	-.74	25.77	.01	-.69	-1.42	.01	.04	1.42	70BA	C402
C420A	0	26.90	-1.75X	-1.30*	25.45	-1.80X	-1.25*	-1.45	-.05	.05	1.45	70BF	C420A
C420B	0	26.85	-1.50X	-1.20*	25.45	-1.55X	-1.20*	-1.40	-.05	.00	1.40	70BF	C420B
C427	0	27.10	1.00*	-.80	25.80	1.10X	-.80	-1.30	.10 *	.00	1.30	70BA	C427
C437	X	26.84	-.00	-.58	26.67*	-.00	-.59	-.17 X	-.00	-.01	17X	70GD	C437
C440	0	27.22	.13	-.46*	25.77	.12	-.44*	-1.45	-.01	.03	1.45	70BA	C440
C442	0	26.50	.30	-.80	25.10	.30	-.80	-1.40	.00	-.00	1.40	70BM	C442
C454	0	27.34	-.00	-.03X	25.85	-.00	.00X	-1.49	-.00	.03	1.49	70BA	C454
C458	0	27.11	.16	-.65	25.37	.20	-.59	-1.74 *	.04	.07	1.75	70BM	C458
C475	0	27.17	-.00	-.78	25.71	-.00	-.71	-1.45	-.00	.07	1.46	70BA	C475
C477	0	27.40	.12	-.62	26.01	.14	-.56	-1.39	.02	.07	1.40	70HA	C477
C494	0	27.45	-.20	-.70	25.90	-.05	-.65	-1.55	.15 X	.05	1.56	70BA	C494
C496B	0	26.90	-1.20X	1.40X	25.40	-1.25X	1.60X	-1.50	-.05	.20 X	1.51	70GF	C496B
C499A	0	27.35	.10	-1.05	25.50	.10	-1.00	-1.85 *	-.00	.05	1.85*	70BA	C499A
C499B	0	27.20	-.10	-.90	26.00	-.05	-.90	-1.20	.05	.00	1.20	70BA	C499B
C506	0	27.10	.10	-.90	25.90	.10	-.80	-1.20	.00	.10	1.20	70BA	C506
C514A	*	27.19	.09	-.83	26.03	.12	-.78	-1.16	.03	.05	1.16	70SF	C514A
C517	0	27.10	-.40	-.60	26.05	-.40	-.55	-1.05	.00	.05	1.05	70BC	C517
C538	0	27.80*	1.70X	-2.00X	26.50*	1.60X	-2.05X	-1.30	-.10 X	-.05 *	1.30	70GX	C538
C541	0	26.55	-.40	-.95	25.20	-.40	-.90	-1.35	-.00	.05	1.35	70GF	C541
C546A	0	26.90	.30	-1.00	25.60	.30	-.90	-1.30	.00	.10	1.30	70BM	C546A
C546B	0	26.75	.30	-.90	25.00	.30	-.90	-1.75 *	.00	-.00	1.75	70BC	C546B
C547	0	24.93X	.23	-.94	23.58X	.25	-.95	-1.35	.02	-.01	1.35	70BC	C547
C574	0	27.40	.75*	-.90	25.90	-.00	-.80	-1.50	-.75 X	.10	1.68	70BC	C574
C576	0	26.80	.22	-.84	25.37	.26	-.80	-1.43	.04	.04	1.43	70BC	C576
C600	0	27.45	-.50	-.30X	25.90	-.50*	-.30*	-1.55	-.00	-.00	1.55	70GD	C600
C619	0	26.80	.40	-1.00	25.30	.40	-.90	-1.50	-.00	.10	1.50	70BC	C619
C620	0	25.63X	.09	-.72	24.15X	.14	-.69	-1.47	.05	.03	1.48	70MG	C620
C633	0	27.12	-.06	-.85	25.78	-.02	-.82	-1.33	.03	.03	1.34	70BA	C633
C655	0	27.05	.06	-.83	25.74	.07	-.80	-1.31	.01	.03	1.31	70BT	C655
C677	0	26.55	-.11	-1.60X	25.37	-.13	-1.49X	-1.18	-.02	.11	1.19	70SC	C677
C690	X	26.50	.20	-1.00	26.48*	.57	-1.00	-.02 X	.37 X	.00	37X	70BM	C690
C719A	0	26.90	-.20	-.75	25.75	-.45*	-.80	-1.15	-.25 X	-.05 *	1.18	70HA	C719A
C719B	0	26.95	-.05	-.90	25.85	-.00	-.90	-1.10	.05	.00	1.10	70BA	C719B
C750	#	29.91X	-1.25X	-6.33X	28.10X	-1.14X	-6.13X	-1.81 *	.11 *	.21 X	1.82*	70IC	C750
GRAND MEANS		27.03	.11	-.85	25.62	.06	-.80	-1.39	.01	.04	1.41		
SD OF MEANS		.30	.32	.16	.35	.24	.18	.17	.03	.04	.18		
INCLUDED LABS FOR THIS MEAN		44	44	42	45	42	43	47	42	46	48		

EXPLANATION OF DATA FOR WHITE SAMPLE FOR PAINT CHIPS

Specimens of a white calibration sample (Paint Chips) were distributed to the participants along with the usual two pairs of colored specimens, and each participant was asked to return measurement data for the white calibration sample (Paint Chips), reporting results in the same manner as for the colored specimens.

As a first step, three laboratories were selected to serve as "reference" laboratories for the purposes of this analysis and the average of their X, Y, Z values for the white sample were computed. Next, the ratios of the participants data to the combined reference laboratory values were calculated for each participant (transformed to X, Y, Z space if necessary). These ratios are shown in the White Sample Analysis tables.

Two observations can be made about the data in the White Sample Analysis tables. First, the participants as a whole tend to be high compared with the combined average values obtained by the selected reference laboratories. Second, a few participants had noticeably extreme values for one or more of the components and these participants especially should look to the cause.

Next, the ratios in the White Sample Analysis tables were used to "adjust" the data of the normal data tables to obtain the adjusted data table values. The adjustment consisted of dividing the X, Y, Z values of the normal data tables by the respective ratios in the White Sample Analysis tables.

The significant change is the adjusted data tables is in the SD OF MEANS. Comparison of these among-laboratory standard deviations with those in the normal data tables, shows considerable reduction for X, Y, Z. Thus part, at least, of the disagreement among participants is due to errors in standardization that could be corrected through use of an agreed-upon white standard. There is no similar significant change for ΔX, ΔY, and ΔZ.

MCCA COLLABORATIVE REFERENCE PROGRAM
WHITE SAMPLE ANALYSIS FOR PAINT CHIPS
X, Y, Z LABORATORIES

LAB CODE	RATIO--(LAB/COMBINED) X	Y	Z	INST CODE	PERCENT FROM COMBINED X	Y	Z
C157	1.0114	1.0051	1.0174	70GE	1.14	.51	1.74
C162	1.0138	1.0105	1.0154	70DC	1.38	1.05	1.54
C251	1.0075	1.0043	1.0106	70ZE	.75	.43	1.06
C283	.9941	.9935	.9938	70BA	-.59	-.65	-.62
C278	1.0257	1.0270	1.0236	70NE	2.57	2.70	2.36
C407	1.0118	1.0100	1.0192	70BL	1.18	1.00	1.92
C414	.9885	.9907	.9867	70MD	-1.15	-.93	-1.33
C416A	1.0446	1.0494	1.0085	70IB	4.46	4.94	.85
C416B	1.0142	1.0196	1.0023	70GE	1.42	1.96	.23
C417B	.9945	.9937	.9979	70HM	-.55	-.63	-.21
C418	.9807	.9773	1.0002	70CE	-1.93	-2.27	.02
C422	.9940	.9935	.9891	70GC	-.60	-.65	-1.09
C424	.9981	.9988	.9984	70CA	-.19	-.12	-.16
C428	1.0075	1.0061	1.0111	70BB	.75	.61	1.11
C443	1.0189	1.0147	1.0313	70CM	1.89	1.47	3.13
C444	1.0127	1.0140	1.0121	70GE	1.27	1.40	1.21
C446	.9991	.9984	1.0010	70GE	-.09	-.16	.10
C451	1.0098	1.0108	1.0062	70AC	.98	1.08	.62
C453	1.0093	1.0090	1.0078	70HT	.93	.90	.78
C455	1.0008	1.0015	.9988	70GE	.08	.15	-.12
C460	1.0045	1.0055	1.0051	70GE	.45	.55	.51
C462A	1.0024	1.0010	1.0106	70BB	.24	.10	1.06
C463	1.0101	1.0060	1.0156	70DC	1.01	.60	1.56
C467A	1.0067	1.0085	1.0100	70GE	.67	.85	1.00
C467B	1.0029	1.0019	1.0094	70BN	.29	.19	.94
C469	1.0191	1.0181	1.0309	70GE	1.91	1.81	3.09
C470	1.0110	1.0110	1.0188	70DB	1.10	1.10	1.88
C472	1.0003	.9998	1.0049	70ZD	.03	-.02	.49
C473	1.0041	1.0032	1.0034	70DB	.41	.32	.34
C474	1.0010	1.0014	1.0046	70GE	.10	.14	.46
C476	1.0058	1.0052	1.0089	70BA	.58	.52	.89
C479B	1.0179	1.0182	1.0228	70CB	1.79	1.82	2.28
C480	1.0061	1.0042	1.0130	70BE	.61	.42	1.30
C481	1.0234	.9755	1.0053	70BB	2.34	-2.45	.53
C482	.9943	.9932	.9897	70GC	-.57	-.68	-1.03
C483	.9835	.9822	.9879	70ZF	-1.65	-1.78	-1.21
C499C	1.0276	1.0280	1.0302	70BL	2.76	2.80	3.02
C503	1.0171	1.0161	1.0241	70GE	1.71	1.61	2.41
C508	1.0044	1.0048	1.0062	70GE	.44	.48	.62
C511	1.0038	1.0039	1.0066	70DB	.38	.39	.66
C512	1.0109	1.0118	1.0021	70AC	1.09	1.18	.21
C514B	.9838	1.0156	.9382	70SP	-1.62	1.56	-6.18
C521A	1.0170	1.0165	1.0333	70CA	1.70	1.65	3.33
C521B	1.0222	1.0211	1.0334	70BA	2.22	2.11	3.34
C526	.9900	.9946	.9791	70DB	-1.00	-.54	-2.09
C528	.9837	.9851	.9778	70MD	-1.63	-1.49	-2.22
C529	.9685	.9922	.9255	70DB	-3.15	-.78	-7.45
C532	1.0094	1.0105	1.0161	70GE	.94	1.05	1.61
C534	.9812	.9856	.9821	70MD	-1.88	-1.44	-1.79
C536	.9753	1.0079	.9063	70AC	-2.47	.79	-9.37
C540	1.0161	1.0160	1.0190	70GE	1.61	1.60	1.90
C545	.9676	.9682	.9730	70GE	-3.24	-3.18	-2.70
C549	1.0073	1.0054	1.0091	70DB	.73	.54	.91
C552	.9969	.9951	1.0045	70BN	-.31	-.49	.45
C612	.9736	1.0060	.9154	70BP	-2.64	.60	-8.46
C613	1.0198	1.0205	1.0221	70MD	1.98	2.05	2.21
C627	.9943	.9933	.9945	70ZB	-.57	-.67	-.55
C630	1.0027	1.0013	1.0097	70KS	.27	.13	.97
C631	1.0108	1.0104	1.0075	70AC	1.08	1.04	.75
C632	1.0090	1.0085	1.0050	70AC	.90	.85	.50
C638	.9944	.9943	.9952	70BA	-.56	-.57	-.48
C639	.9944	.9935	.9967	70DB	-.56	-.65	-.33
C644	1.0014	1.0030	.9966	70MD	.14	.30	-.34
C645	1.0109	1.0107	1.0061	70AC	1.09	1.07	.61
C656	1.0093	1.0079	1.0113	70SA	.93	.79	1.13
C657	.9781	1.0094	.9246	70AC	-2.19	.94	-7.54
C662	.9714	.9962	.9238	70SP	-2.86	-.38	-7.62
C672	1.0025	1.0010	.9971	70GC	.25	.10	-.29
C675	1.0113	1.0112	1.0078	70AC	1.13	1.12	.78
C683	1.0168	1.0151	1.0090	70GC	1.68	1.51	.90
C691	.9964	.9922	.9996	70ZB	-.36	-.78	-.04
C700	.9969	.9968	.9959	70DB	-.31	-.32	-.41
C705	1.0326	.0034	.0031	70BP	3.26	-99.66	-99.69
C707	.8043	.8037	.8045	70SA	-19.57	-19.63	-19.55
C708A	.9849	.9841	.9827	70BY	-1.51	-1.59	-1.73
C708B	.0024	.0025	.0027	70SS	-99.76	-99.75	-99.73
C709	1.0025	1.0024	1.0038	70KS	.25	.24	.38
C716	1.0001	.9977	1.0049	70ZE	.01	-.23	.49
C717A	.9758	1.0004	.9298	70SP	-2.42	.04	-7.02
C717B	.9755	.9997	.9306	70SP	-2.45	-.03	-6.94
C718A	.9800	1.0109	.9273	70AC	-2.00	1.09	-7.27
C718B	.9802	1.0108	.9284	70AC	-1.98	1.08	-7.16
C719C	.9717	.9693	.9810	70KC	-2.83	-3.07	-1.90
C720A	.9727	.9970	.9270	70SP	-2.73	-.30	-7.30
C720B	.9709	.9952	.9264	70SP	-2.91	-.48	-7.36
C723	.9861	.9871	.9780	70MD	-1.39	-1.29	-2.20
C724	1.0041	1.0027	1.0063	70ZA	.41	.27	.63
C725	.9856	.9868	.9852	70KS	-1.44	-1.32	-1.48
C726	1.0148	1.0135	1.0225	70BA	1.48	1.35	2.25
C727A	.9727	.9973	.9273	70SP	-2.73	-.27	-7.27
C727B	.9715	.9957	.9263	70SP	-2.85	-.43	-7.37
C741	1.0081	1.0072	1.0086	70CE	.81	.72	.86
C742	.9702	.9933	.9231	70DB	-2.98	-.67	-7.69
C748	1.0034	1.0023	1.0116	70BP	.34	.23	1.16
C749	.9754	1.0060	.9234	70AC	-2.46	.60	-7.66
C752A	.9978	.9976	1.0026	70DB	-.22	-.24	.26
C752B	1.0023	1.0016	1.0072	70BN	.23	.16	.72

WHITE SAMPLE ANALYSIS FOR PAINT CHIPS
L, a, b LABORATORIES

LAB CODE	RATIO--(LAB/COMBINED) X	Y	Z	INST CODE	PERCENT FROM COMBINED X	Y	Z
C121	.9897	.9870	.9978	70HA	-1.03	-1.30	-.22
C148	.9958	.9943	1.0022	70HF	-.42	-.57	.22
C152	.9982	.9964	1.0066	70HA	-.18	-.36	.66
C166	.9903	.9891	1.0038	70HA	-.97	-1.09	.38
C183	.9864	.9849	.9919	70HA	-1.36	-1.51	-.81
C241	.9922	.9901	1.0025	70HF	-.78	-.99	.25
C255	.9930	.9911	.9998	70HA	-.70	-.89	-.02
C256A	.9854	.9832	.9938	70SC	-1.46	-1.68	-.62
C256B	.9883	.9877	.9897	70HU	-1.17	-1.23	-1.03
C288	.9867	.9849	.9949	70HM	-1.33	-1.51	-.51
C291	.9897	.9891	.9969	70HA	-1.03	-1.09	-.31
C317	.9821	.9797	.9881	70HM	-1.79	-2.03	-1.19
C325	.9957	.9925	1.0017	70HC	-.43	-.75	.17
C356	1.0099	1.0104	1.0117	70IC	.99	1.04	1.17
C380	.9888	.9870	.9963	70HA	-1.12	-1.30	-.37
C382	.9903	.9891	.9976	70HA	-.97	-1.09	-.24
C390	.9946	.9922	1.0016	70HF	-.54	-.78	.16
C402	.9886	.9870	.9961	70HA	-1.14	-1.30	-.39
C420A	.9963	.9932	.9996	70HF	-.37	-.68	-.04
C420H	.9984	.9953	1.0017	70HF	-.16	-.47	.17
C427	.9925	.9901	.9933	70HA	-.75	-.99	-.67
C437	.9819	.9810	.9824	70GD	-1.81	-1.90	-1.76
C440	1.0030	.9998	1.0075	70HA	.30	-.02	.75
C442	.9861	.9849	.9949	70HM	-1.39	-1.51	-.51
C454	1.0023	.9991	1.0116	70HA	.23	-.09	1.16
C458	.9878	.9854	.9969	70HM	-1.22	-1.46	-.31
C475	.9978	.9941	1.0072	70HA	-.22	-.59	.72
C477	.9501	.9427	.9293	70HA	-4.99	-5.73	-7.07
C494	.9501	.9427	.9293	70HA	-4.99	-5.73	-7.07
C496H	1.0096	1.0089	1.0117	70GP	.96	.89	1.17
C499A	.9940	.9922	1.0031	70HA	-.60	-.78	.31
C499B	.9940	.9922	1.0001	70HA	-.60	-.78	.01
C506	.9955	.9943	1.0053	70HA	-.45	-.57	.53
C514A	.9800	.9789	.9815	70SR	-2.00	-2.11	-1.85
C517	1.0194	1.0163	1.0215	70HQ	1.94	1.63	2.15
C538	.9695	.9725	.9739	70GX	-3.05	-2.75	-2.61
C541	.9934	1.0026	1.0076	70GP	-.66	.26	.76
C546A	.9852	.9828	.9943	70HM	-1.48	-1.72	-.57
C546H	.9919	.9901	.9941	70HQ	-.81	-.99	-.59
C547	.9880	.9856	.9931	70HQ	-1.20	-1.44	-.69
C574	1.0470	1.0322	1.0385	70HQ	4.70	3.22	3.85
C576	.9799	.9777	.9918	70HO	-2.01	-2.23	-.82
C600	.9894	.9870	.9940	70GD	-1.06	-1.30	-.60
C619	.9951	.9932	.9988	70HQ	-.49	-.68	-.12
C620	.9426	.9435	.9352	70MG	-5.74	-5.65	-6.48
C633	.9902	.9884	.9998	70HA	-.98	-1.16	-.02
C655	.9962	.9956	.9925	70HU	-.38	-.44	-.75
C677	1.0333	1.0305	1.0444	70SC	3.33	3.05	4.44
C690	.9860	.9839	.9923	70HM	-1.40	-1.61	-.77
C719A	1.0102	1.0089	1.0272	70HA	1.02	.89	2.72
C719B	.9952	.9922	1.0085	70HA	-.48	-.78	.85
C750	.9737	.9932	1.1702	70IC	-2.63	-.68	17.02

MCCA COLLABORATIVE REFERENCE PROGRAM
X, Y, Z SPACE ANALYSIS, ADJUSTED DATA
COLOR + COLOR DIFFERENCE
FOR PAINT CHIPS

LAB		SAMPLE D17			SAMPLE D18			DIFFERENCE D18 - D17				INST	
CODE	F	MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ	ΔE	CODE	LAB
C157	0	39.22	30.50	27.53	38.67	29.76	27.33	-.55	-.74	-.21	3.30	70GE	C157
C162	0	40.81*	31.66*	26.99	40.32*	30.96*	26.92	-.49	-.70	-.07	3.20	70DC	C162
C251	0	39.38	29.67	26.53	38.73	28.88	26.29	-.66	-.80	-.24	3.30	70ZE	C251
C253	#	38.71	29.59	27.02	38.13	28.89	26.94	-.58	-.70	-.09	2.77	70SA	C253
C278	0	37.44*	29.55	25.50X	36.66*	28.72	25.25X	-.78	-.83	-.24	2.57	70NE	C278
C407	0	39.63	30.85	27.83	39.09	30.13	27.71	-.54	-.71	-.11	2.99	70EL	C407
C414	0	39.74	30.46	26.80	39.30	29.86	26.77	-.43	-.61	-.03	2.78	70MD	C414
C416A	0	35.05X	27.91X	27.21	34.36X	27.18X	27.09	-.69	-.73	-.12	2.35	70IE	C416A
C416B	0	35.39X	28.22X	27.54	34.68X	27.41X	27.34	-.71	-.81	-.19	2.82	70GE	C416B
C417B	0	38.82	29.84	26.90	38.20	29.08	26.76	-.61	-.76	-.14	3.13	70BN	C417B
C418	0	39.43	30.74	27.17	38.88	30.03	27.02	-.55	-.70	-.15	2.91	70CE	C418
C422	0	38.29	29.17	26.54	37.78	28.51	26.48	-.51	-.66	-.06	2.85	70GC	C422
C424	0	39.45	30.67	28.20*	38.91	29.95	28.08*	-.54	-.72	-.11	3.04	70CA	C424
C428	0	39.17	30.07	26.96	38.60	29.38	26.91	-.57	-.70	-.05	2.76	70BE	C428
C443	0	39.39	30.49	26.71	39.27	30.11	26.96	-.12 X	-.38 X	.25 *	2.72	70CM	C443
C444	0	38.93	30.06	27.33	38.75	29.70	27.57	-.18 X	-.36 X	.24 *	2.13*	70GE	C444
C446	0	39.04	30.12	28.01	38.87	29.75	28.17*	-.18 X	-.37 X	.15	2.23*	70GE	C446
C451	0	40.07	30.68	26.51	39.72	30.17	26.63	-.34 *	-.51 *	.11	2.47	70AC	C451
C453	0	39.66	30.39	27.00	39.36	29.91	27.13	-.30 *	-.48 *	.13	2.46	70BT	C453
C459	0	38.73	29.92	27.36	38.22	29.22	27.26	-.51	-.70	-.11	3.20	70GE	C459
C460	0	38.88	29.97	26.91	38.05	29.00	26.53	-.83	-.97 *	-.39	3.73	70GE	C460
C462A	0	38.96	30.02	26.82	38.46	29.42	26.82	-.50	-.60	.00	2.30	70BE	C462A
C463	0	39.60	30.42	26.70	39.11	29.80	26.71	-.50	-.62	.01	2.45	70DC	C463
C467A	0	38.65	29.91	29.10X	38.16	29.29	29.05X	-.49	-.62	-.05	2.54	70GE	C467A
C467B	0	38.75	29.83	26.65	38.27	29.20	26.67	-.48	-.62	.02	2.66	70BN	C467B
C469	0	39.07	30.30	27.40	38.60	29.63	27.34	-.47	-.66	-.06	3.09	70GE	C469
C470	0	39.60	30.71	27.50	39.08	29.99	27.40	-.51	-.71	-.10	3.22	70DB	C470
C472	0	40.94*	31.98X	28.02	40.46*	31.27X	27.94	-.48	-.72	-.08	3.38	70ZD	C472
C473	0	39.72	30.55	27.00	39.16	29.85	26.90	-.56	-.70	-.09	2.83	70DB	C473
C474	0	39.05	30.29	28.11*	38.38	29.48	27.86	-.66	-.81	-.25	3.17	70GE	C474
C476	0	38.85	29.64	26.41	38.22	28.87	26.27	-.63	-.77	-.14	3.15	70SA	C476
C479B	0	39.04	30.07	27.08	38.44	29.31	26.93	-.61	-.76	-.15	3.10	70CE	C479B
C480	0	37.56*	28.96*	25.03X	36.92*	28.22*	24.87X	-.64	-.75	-.16	2.86	70BE	C480
C481	0	37.81	30.70	26.76	37.18	29.93	26.66	-.64	-.77	-.10	2.74	70BE	C481
C482	0	38.63	29.51	26.57	38.01	28.71	26.37	-.63	-.81	-.21	3.51	70GC	C482
C483	0	39.34	29.73	27.02	38.76	29.02	26.90	-.58	-.71	-.12	2.94	70ZF	C483
C499C	0	38.12	29.32	28.88X	37.61	28.68	28.73X	-.51	-.64	-.16	2.67	70EL	C499C
C503	0	38.69	29.93	27.45	38.16	29.23	27.29	-.54	-.70	-.16	3.07	70GE	C503
C508	0	39.71	30.72	28.14*	39.15	29.98	27.93	-.56	-.74	-.20	3.26	70GE	C508
C511	0	39.49	30.38	26.89	38.92	29.64	26.76	-.57	-.74	-.13	3.19	70DB	C511
C512	0	40.03	30.77	26.53	39.45	30.03	26.42	-.57	-.74	-.10	3.12	70AC	C512
C514B	+	39.41	30.09	27.93	38.84	29.37	27.77	-.57	-.72	-.16	3.02	70SF	C514B
C521A	0	39.02	30.02	27.21	38.37	29.25	26.99	-.65	-.77	-.22	2.94	70CA	C521A
C521B	0	38.87	29.91	26.44	37.81	28.78	25.85*	-1.06 X	-1.13 X	-.59 *	3.75	70SA	C521B
C526	0	36.51X	29.29	28.00	35.77X	28.46	27.72	-.74	-.83	-.28	2.78	70DB	C526
C528	0	40.52	31.21	27.62	39.79	30.32	27.23	-.72	-.89	-.38	3.62	70MD	C528
C529	0	39.86	30.36	26.79	39.20	29.56	26.57	-.66	-.80	-.22	3.24	70DB	C529
C532	0	39.83	31.24	30.03X	39.24	30.47	29.80X	-.59	-.77	-.23	3.18	70GE	C532
C534	0	41.24*	31.51*	27.44	40.66*	30.78*	27.33	-.59	-.73	-.10	2.91	70MD	C534
C536	0	39.18	30.16	27.36	38.40	29.33	27.04	-.78	-.83	-.31	2.63	70AC	C536
C540	0	39.04	30.31	28.10*	38.30	29.43	27.69	-.74	-.89	-.41	3.46	70GE	C540
C545	0	39.18	30.29	27.33	38.47	29.42	26.98	-.71	-.87	-.34	3.58	70GE	C545
C549	0	39.87	30.65	26.70	39.56	30.17	26.91	-.31 *	-.48 *	.21 *	2.40	70DB	C549
C552	0	38.73	29.89	26.84	38.16	29.19	26.75	-.57	-.70	-.09	2.79	70BN	C552
C612	+	37.20*	28.66*	26.91	36.56*	27.98*	26.80	-.64	-.68	-.11	2.26	70SP	C612
C613	0	39.65	30.79	25.34X	38.81	29.79	24.82X	-.84	-1.00 *	-.53 *	4.02*	70MD	C613
C627	0	39.78	30.79	27.74	39.09	29	27.53	-.69	-.85	-.22	3.32	70ZE	C627
C630	0	39.06	30.13	26.82	38.49	29.39	26.67	-.58	-.74	-.15	3.10	70KS	C630
C631	0	39.52	30.39	26.63	38.97	29.71	26.56	-.54	-.68	-.07	2.77	70AC	C631
C632	0	39.70	30.50	26.60	39.36	30.03	26.82	-.34 *	-.47 *	.22 *	2.16*	70AC	C632
C638	0	38.92	29.37	27.23	38.11	28.46	26.98	-.80	-.91	-.25	3.32	70SA	C638
C639	0	40.39	31.22	26.84	39.73	30.42	26.68	-.66	-.80	-.17	3.02	70DB	C639
C644	0	39.54	30.24	26.68	38.76	29.34	26.32	-.78	-.90	-.35	3.42	70MD	C644
C645	0	39.78	30.53	26.77	39.11	29.73	26.60	-.67	-.80	-.16	3.05	70AC	C645
C656	0	38.82	29.96	26.42	38.41	29.34	26.40	-.41	-.63	-.02	3.19	70SA	C656

MCCA COLLABORATIVE REFERENCE PROGRAM
X, Y, Z SPACE ANALYSIS, ADJUSTED DATA
COLOR + COLOR DIFFERENCE
FOR PAINT CHIPS

LAB		SAMPLE D17			SAMPLE D18			DIFFERENCE D18 - D17				INST	
CODE	F	MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ	ΔE	CODE	LAB
C657	0	39.62	30.09	26.65	39.01	29.37	26.51	-.60	-.72	-.14	2.84	70AC	C657
C662	+	39.48	30.00	26.87	38.91	29.31	26.77	-.57	-.70	-.10	2.80	70SF	C662
C672	0	38.56	29.67	26.78	37.87	28.82	26.58	-.70	-.85	-.20	3.39	70GC	C672
C675	0	39.36	30.28	26.64	38.68	29.47	26.40	-.67	-.81	-.24	3.14	70AC	C675
C683	0	37.16*	28.05X	24.90X	36.44*	27.22X	24.70X	-.72	-.83	-.20	3.21	70GC	C683
C691	0	38.82	29.40	26.62	38.12	28.64	26.44	-.70	-.76	-.19	2.64	70ZE	C691
C700	0	39.59	30.47	26.96	38.98	29.70	26.77	-.61	-.76	-.19	3.10	70DB	C700
C705	#	29.18X	116.40X	100.41X	28.37X	116.40X	100.41X	-.81	.00 X	.00	2.35	70BF	C705
C707	#	34.71X	26.10X	22.95X	34.23X	25.49X	22.85X	-.48	-.60	-.10	2.76	70SA	C707
C708A	0	42.91X	33.40X	27.93	42.41X	32.71X	27.91	-.50	-.69	-.02	2.91	70BT	C708A
C708B	+	187.60X	311.81X	336.86X	187.60X	315.74X	336.86X	.00 X	3.92 X	.00	*****X	70SS	C708B
C709	0	39.05	29.94	26.67	38.43	29.18	26.53	-.62	-.76	-.14	3.00	70KS	C709
C716	0	37.81	29.77	26.67	37.26	29.07	26.68	-.55	-.70	.00	2.84	70ZE	C716
C717A	+	40.03	30.51	26.75	39.52	29.84	26.67	-.51	-.67	-.08	2.94	70SP	C717A
C717B	+	40.02	30.52	26.98	39.38	29.74	26.77	-.64	-.78	-.20	3.12	70SF	C717B
C718A	0	39.96	30.38	26.73	39.21	29.53	26.48	-.75	-.86	-.26	3.14	70AC	C718A
C718B	0	39.75	30.19	26.57	39.03	29.35	26.35	-.72	-.84	-.23	3.16	70AC	C718B
C719C	0	38.80	29.55	26.77	38.19	28.80	26.66	-.62	-.75	-.11	3.00	70KC	C719C
C720A	+	39.83	30.32	26.98	39.05	29.42	26.64	-.78	-.90	-.34	3.36	70SF	C720A
C720B	+	39.88	30.37	26.92	39.12	29.48	26.60	-.76	-.88	-.32	3.39	70SF	C720B
C723	0	40.15	30.85	27.06	39.41	29.97	26.77	-.74	-.88	-.29	3.39	70MD	C723
C724	0	39.26	30.41	27.76	38.56	29.55	27.47	-.70	-.86	-.29	3.39	70ZA	C724
C725	0	39.14	30.22	26.71	38.65	29.50	26.98	-.49	-.71	.27 *	3.42	70KS	C725
C726	0	40.62	31.30	27.38	40.02	30.51	27.26	-.60	-.78	-.12	3.30	70SA	C726
C727A	+	39.65	30.17	26.69	39.23	29.59	26.75	-.42	-.58	.06	2.61	70SF	C727A
C727B	+	39.69	30.22	26.79	39.20	29.57	26.76	-.49	-.65	-.03	2.89	70SF	C727B
C741	0	38.98	29.90	27.09	38.46	29.22	28.04*	-.52	-.68	.95 X	4.03*	70CB	C741
C742	#	40.55	30.68	26.69	40.06	30.05	26.68	-.49	-.63	-.01	2.67	70DB	C742
C748	0	38.88	29.94	26.88	38.26	29.20	26.77	-.62	-.74	-.12	2.79	70BE	C748
C749	0	40.05	30.41	26.83	39.17	29.45	26.41	-.88 *	-.96 *	-.42	3.41	70AC	C749
C752A	0	39.27	30.44	27.26	38.60	29.62	26.99	-.67	-.82	-.27	3.31	70DB	C752A
C752B	0	38.73	29.86	26.67	38.05	29.08	26.51	-.68	-.78	-.15	2.82	70BN	C752B
GRAND MEANS		39.26	30.24	27.07	38.67	29.50	26.95	-.60	-.75	-.14	3.02		
SD OF MEANS		.74	.54	.48	.77	.55	.50	.12	.10	.16	.39		
INCLUDED LABS FOR THIS MEAN		79	78	76	79	78	76	79	79	82	83		

X, Y, Z SPACE ANALYSIS, ADJUSTED DATA
COLOR + COLOR DIFFERENCE
FOR PAINT CHIPS

LAB		SAMPLE D19			SAMPLE D20			DIFFERENCE D20 - D19				INST	
CODE	F	MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ	ΔE	CODE	LAB
C157	0	7.43	7.61	9.51	6.58	6.71	8.42	-.85	-.90	-1.09	4.34	70GE	C157
C162	0	7.78	7.94*	9.56	7.09*	7.23*	8.72	-.70	-.71	-.84	3.33	70DC	C162
C251	0	7.18	7.27	8.99	6.38	6.47	7.95	-.79	-.80	-1.05	3.94	70ZE	C251
C253	*	6.95	7.18	8.77	6.19	6.40	7.81	-.76	-.78	-.97	3.87	70SA	C253
C278	0	6.87	7.16	8.65	6.14	6.38	7.67	-.73	-.78	-.98	3.91	70NE	C278
C407	0	7.50	7.62	9.33	6.88	6.99	8.58	-.62	-.63	-.76	3.01	70EL	C407
C414	0	7.02	7.15	8.75	6.39	6.51	7.97	-.63	-.64	-.78	3.18	70MD	C414
C416A	0	6.91	7.02	8.81	6.17	6.27	7.85	-.74	-.75	-.95	3.78	70IE	C416A
C416B	0	6.65*	6.76*	8.50	5.99*	6.09*	7.66	-.65	-.67	-.84	3.42	70GE	C416B
C417B	0	7.08	7.17	8.96	6.39	6.48	8.10	-.69	-.69	-.87	3.44	70BN	C417B
C418	0	7.82*	7.97*	9.60	6.99	7.11	8.53	-.83	-.85	-1.06	4.01	70CE	C418
C422	0	6.92	7.06	8.62	6.24	6.35	7.77	-.68	-.70	-.85	3.53	70GC	C422
C424	0	7.50	7.64	9.45	6.88	7.00	8.68	-.62	-.64	-.77	3.04	70CA	C424
C428	0	7.03	7.17	8.79	6.51	6.63	8.15	-.53 *	-.54 *	-.64 *	2.66*	70BE	C428
C443	0	7.35	7.48	9.20	6.60	6.69	8.26	-.75	-.78	-.94	3.81	70CM	C443
C444	0	7.40	7.52	9.37	6.63	6.75	8.38	-.77	-.77	-.99	3.74	70GE	C444
C446	0	7.43	7.57	9.34	6.69	6.81	8.39	-.74	-.76	-.95	3.64	70GE	C446
C451	0	7.24	7.38	9.07	6.58	6.70	8.23	-.66	-.68	-.84	3.31	70AC	C451
C453	0	7.37	7.51	9.34	6.55	6.67	8.30	-.82	-.84	-1.04	4.06	70BT	C453
C459	0	7.35	7.48	9.28	6.48	6.60	8.18	-.87	-.89	-1.10	4.29	70GE	C459
C460	0	6.92	7.06	8.77	6.02*	6.14*	7.61	-.90	-.91	-1.16	4.58	70GE	C460
C462A	0	7.13	7.34	8.95	6.33	6.49	7.97	-.80	-.85	-.99	4.16	70BE	C462A
C463	0	7.33	7.48	9.11	6.53	6.66	8.10	-.80	-.82	-1.01	3.99	70DC	C463
C467A	0	7.55	7.70	9.55	6.77	6.89	8.54	-.78	-.81	-1.00	3.85	70GE	C467A
C467B	0	7.08	7.23	8.89	6.31	6.43	7.90	-.78	-.80	-1.00	3.94	70BN	C467B
C469	0	7.54	7.67	9.51	6.73	6.84	8.48	-.81	-.83	-1.03	3.96	70GE	C469
C470	0	7.33	7.46	9.20	6.52	6.63	8.18	-.81	-.83	-1.02	4.00	70DB	C470
C472	0	7.56	7.69	9.42	6.82	6.94	8.46	-.74	-.75	-.97	3.57	70ZD	C472
C473	0	7.29	7.42	9.16	6.53	6.64	8.18	-.77	-.78	-.98	3.78	70DB	C473
C474	0	7.74	7.88	9.90*	6.94	7.06	8.92*	-.80	-.82	-.99	3.84	70GE	C474
C476	0	7.09	7.21	9.26	6.17	6.27	8.11	-.91	-.94	-1.15	4.64	70SA	C476
C479B	0	7.19	7.31	9.04	6.50	6.62	8.13	-.69	-.69	-.92	3.39	70CE	C479B
C480	0	7.17	7.35	8.87	6.37	6.52	7.88	-.80	-.83	-.99	4.06	70BE	C480
C481	0	7.18	7.43	9.05	6.25	6.46	7.86	-.93 *	-.97 *	-1.19 *	4.73*	70BE	C481
C482	0	6.86	7.02	8.60	6.03*	6.16	7.54*	-.82	-.86	-1.06	4.31	70GC	C482
C483	0	7.73	7.64	9.56	6.88	6.72	8.49	-.86	-.92	-1.08	4.60	70ZF	C483
C499C	0	7.68	7.79	9.66	6.68	6.79	8.39	-1.00 *	-1.00 *	-1.27 *	4.74*	70EL	C499C
C503	0	7.22	7.34	9.11	6.58	6.69	8.29	-.63	-.65	-.82	3.21	70GE	C503
C508	0	7.18	7.31	9.11	6.62	6.74	8.42	-.56	-.58	-.70	2.83	70GE	C508
C511	0	7.32	7.46	9.18	6.69	6.81	8.37	-.63	-.65	-.81	3.14	70DB	C511
C512	0	7.23	7.36	9.07	6.61	6.74	8.28	-.61	-.63	-.79	3.07	70AC	C512
C514B	+	7.14	7.27	9.03	6.53	6.65	8.23	-.61	-.62	-.79	3.03	70SF	C514B
C521A	0	7.32	7.43	9.16	6.63	6.73	8.27	-.69	-.69	-.89	3.38	70CA	C521A
C521B	0	6.72*	6.87*	8.53	6.27	6.39	7.98	-.45 *	-.48 *	-.55 *	2.45*	70SA	C521B
C526	0	7.29	7.42	9.21	6.69	6.80	8.44	-.60	-.62	-.78	3.01	70DB	C526
C528	0	7.31	7.46	9.21	6.61	6.73	8.33	-.71	-.73	-.88	3.51	70MD	C528
C529	0	7.28	7.42	9.10	6.58	6.70	8.22	-.70	-.72	-.89	3.50	70DB	C529
C532	0	7.02	7.16	8.78	6.36	6.49	7.99	-.65	-.67	-.79	3.34	70GE	C532
C534	0	7.45	7.40	9.08	6.72	6.63	8.12	-.74	-.78	-.96	3.94	70MD	C534
C536	0	7.25	7.41	9.18	6.53	6.67	8.26	-.72	-.74	-.92	3.59	70AC	C536
C540	0	7.90*	8.06*	9.89*	7.09*	7.23*	8.87*	-.82	-.83	-1.02	3.86	70GE	C540
C545	0	7.03	7.17	8.90	6.44	6.56	8.12	-.59	-.61	-.78	3.04	70GE	C545
C549	0	7.16	7.30	8.98	6.43	6.54	8.06	-.73	-.76	-.92	3.71	70DB	C549
C552	0	7.04	7.19	8.83	6.32	6.44	7.92	-.72	-.74	-.91	3.68	70BN	C552
C612	+	6.55*	6.69*	8.34*	5.79*	5.91*	7.41*	-.76	-.78	-.93	4.03	70SF	C612
C613	0	6.21X	6.99	6.69X	5.47X	6.22	5.74X	-.74	-.77	-.94	4.11	70ND	C613
C627	0	7.51	7.67	9.50	6.69	6.82	8.45	-.82	-.85	-1.06	4.04	70ZE	C627
C630	0	7.43	7.58	9.33	6.70	6.82	8.42	-.73	-.76	-.92	3.64	70BS	C630
C631	0	7.24	7.37	9.08	6.43	6.55	8.04	-.81	-.82	-1.04	4.01	70AC	C631
C632	0	7.31	7.45	9.19	6.61	6.74	8.31	-.70	-.71	-.88	3.44	70AC	C632
C638	0	7.24	7.44	9.04	6.54	6.64	8.14	-.70	-.80	-.90	4.23	70SA	C638
C639	0	7.34	7.47	9.21	6.70	6.82	8.41	-.63	-.65	-.80	3.17	70DB	C639
C644	0	6.87	6.92	8.43*	6.37	6.41	7.80	-.50 *	-.51 *	-.63 *	2.58*	70ND	C644
C645	0	7.23	7.36	9.05	6.58	6.69	8.23	-.65	-.67	-.82	3.26	70AC	C645
C656	0	6.80	6.94	8.50	6.06	6.18	7.56*	-.73	-.75	-.94	3.82	70SA	C656

MCCA COLLABORATIVE REFERENCE PROGRAM
X, Y, Z SPACE ANALYSIS, ADJUSTED DATA
COLOR • COLOR DIFFERENCE
FOR PAINT CHIPS

LAB		SAMPLE D19			SAMPLE D20			DIFFERENCE D20 - D19				INST	
CODE	F	MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ	ΔE	CODE	LAB
C657	O	7.29	7.43	9.16	6.46	6.58	8.11	-.83	-.85	-1.05	4.14	70AC	C657
C662	•	7.20	7.33	9.06	6.51	6.62	8.19	-.69	-.71	-.87	3.46	70SF	C662
C672	O	6.88	7.04	8.62	6.18	6.29	7.72	-.70	-.75	-.90	3.83	70GC	C672
C675	O	7.17	7.30	8.97	6.55	6.67	8.19	-.62	-.63	-.78	3.11	70AC	C675
C683	O	6.54*	6.87*	8.44	5.87*	6.18	7.58	-.67	-.69	-.86	3.52	70GC	C683
C691	O	7.26	7.36	8.31*	6.64	6.75	7.57*	-.62	-.61	-.74	3.02	70ZE	C691
C700	O	7.16	7.29	8.99	6.57	6.68	8.25	-.59	-.61	-.74	3.00	70DB	C700
C705	#	6.97	90.21X	100.41X	6.33	90.21X	100.41X	-.64	.00 X	.00 X	2.07X	70BF	C705
C707	#	6.20X	6.31X	7.95X	5.64X	5.74X	7.23X	-.56	-.57	-.71	3.06	70SA	C707
C708A	O	7.72	7.88	9.69	6.94	7.08	8.70	-.78	-.80	-.99	3.75	70BT	C708A
C708B	•	508.85X	478.51X	522.57X	528.77X	498.12X	539.84X	19.92 X	19.61 X	17.28 X	*****X	70SS	C708B
C709	O	7.58	7.71	9.47	6.82	6.94	8.51	-.76	-.77	-.96	3.68	70KS	C709
C716	O	7.33	7.42	9.16	6.55	6.62	8.23	-.78	-.80	-.94	3.90	70ZE	C716
C717A	•	7.36	7.50	9.22	6.55	6.67	8.19	-.81	-.82	-1.03	3.99	70SF	C717A
C717B	•	7.43	7.57	9.34	6.62	6.75	8.31	-.81	-.83	-1.03	3.97	70SF	C717B
C718A	O	7.28	7.41	9.11	6.56	6.67	8.19	-.72	-.74	-.92	3.61	70AC	C718A
C718B	O	7.13	7.27	8.91	6.46	6.57	8.08	-.67	-.69	-.83	3.41	70AC	C718B
C719C	O	7.30	7.44	9.13	6.59	6.70	8.23	-.72	-.73	-.90	3.55	70KC	C719C
C720A	•	7.24	7.38	9.08	6.68	6.80	8.39	-.57	-.58	-.69	2.83	70SF	C720A
C720B	•	7.23	7.37	9.07	6.67	6.80	8.39	-.56	-.57	-.68	2.79	70SF	C720B
C723	O	7.17	7.31	9.07	6.35	6.47	8.02	-.83	-.84	-1.05	4.12	70MD	C723
C724	O	7.30	7.43	9.15	6.48	6.59	8.12	-.82	-.84	-1.03	4.07	70ZA	C724
C725	X	8.47X	7.56	9.48	6.62	6.75	8.34	-1.85 X	-.82	-1.14	23.25X	70KS	C725
C726	O	7.43	7.56	9.36	6.85	6.97	8.62	-.58	-.59	-.74	2.83	70SA	C726
C727A	•	7.32	7.46	9.20	6.51	6.63	8.17	-.81	-.83	-1.04	4.03	70SF	C727A
C727B	•	7.33	7.48	9.22	6.60	6.72	8.27	-.74	-.76	-.95	3.68	70SF	C727B
C741	O	7.50	7.62	9.66	6.76	6.86	8.69	-.74	-.76	-.97	3.64	70CE	C741
C742	#	108.42X	111.07X	130.48X	97.05X	99.36X	116.62X	-11.37 X	-11.71 X	-13.86 X	9.31X	70DB	C742
C748	O	7.20	7.38	9.04	6.58	6.74	8.26	-.62	-.63	-.78	3.09	70BE	C748
C749	O	7.49	7.63	9.39	6.65	6.78	8.34	-.84	-.85	-1.05	4.07	70AC	C749
C752A	O	7.22	7.35	9.03	6.52	6.64	8.16	-.70	-.71	-.87	3.48	70DB	C752A
C752B	O	7.00	7.13	8.77	6.25	6.36	7.82	-.75	-.76	-.94	3.80	70BN	C752B
GRAND MEANS		7.26	7.39	9.11	6.53	6.64	8.19	-.73	-.75	-.92	3.66		
SD OF MEANS		.27	.26	.34	.25	.24	.31	.10	.10	.13	.50		
INCLUDED LABS FOR THIS MEAN		81	82	81	81	82	81	82	82	82	82		

MCCA COLLABORATIVE REFERENCE PROGRAM
L, a, b SPACE ANALYSIS, ADJUSTED DATA
COLOR • COLOR DIFFERENCE
FOR PAINT CHIPS

LAB CODE	F	SAMPLE D17 MEAN L	SAMPLE D17 MEAN A	SAMPLE D17 MEAN B	SAMPLE D18 MEAN L	SAMPLE D18 MEAN A	SAMPLE D18 MEAN B	DIFFERENCE D18 - D17 ΔL	ΔA	ΔB	ΔE	INST CODE	LAB
C121	0	54.00	31.76	11.16X	53.20	32.57	10.56X	-.81 *	.81	-.60 *	1.29	70BA	C121
C148	0	55.06	31.64	9.26	54.36	32.35	8.51	-.70	.70	-.75	1.24	70BF	C148
C152	0	55.35	30.57	9.42	54.75	31.27	8.72	-.60	.70	-.70	1.16	70BA	C152
C166	0	55.30	30.96	9.53	54.60	31.67	8.83	-.70	.70	-.70	1.22	70BA	C166
C183	0	54.82	31.70	9.47	54.11	32.40	8.77	-.71	.71	-.70	1.22	70BA	C183
C241	0	55.53	30.78	9.81	54.82	31.43	9.16	-.70	.65	-.65	1.16	70BF	C241
C255	0	55.45	30.25	9.55	54.69	30.95	8.69	-.75	.70	-.85 *	1.34*	70BA	C255
C256A	0	55.13	31.14	9.40	54.48	31.89	8.71	-.65	.75	-.69	1.21	70SC	C256A
C256B	0	55.84	31.58	10.27*	55.13	32.46	9.64*	-.70	.88	-.62	1.29	70BL	C256B
C288	0	55.12	31.40	9.57	54.41	32.11	8.86	-.71	.71	-.70	1.22	70BM	C288
C291	0	55.00	31.34	8.93	54.30	32.04	8.23	-.70	.70	-.70	1.22	70BA	C291
C317	0	54.86	31.11	9.24	54.25	31.82	8.44	-.61	.71	-.80	1.23	70BM	C317
C325	0	54.80	30.30	8.70	54.06	30.98	8.02	-.74	.68	-.68	1.21	70BC	C325
C356	0	53.21*	31.17	8.28*	52.59*	31.83	7.59*	-.63	.66	-.69	1.14	70IC	C356
C380	0	55.36	31.92	9.54	54.71	32.83	8.83	-.65	.91 *	-.70	1.32	70BA	C380
C382	0	55.30	30.71	9.50	54.55	31.47	8.85	-.75	.75	-.65	1.25	70BA	C382
C390	0	55.12	31.66	9.01	54.51	32.41	8.26	-.60	.75	-.75	1.22	70BF	C390
C402	0	55.07	30.98	9.10	54.48	31.69	8.35	-.59	.71	-.75	1.19	70BA	C402
C420A	0	54.69	31.22	8.92	53.98	31.97	8.22	-.70	.75	-.70	1.25	70BF	C420A
C420B	0	54.58	31.34	9.01	54.03	31.94	8.21	-.55 *	.60	-.80	1.14	70BF	C420B
C427	0	55.37	31.44	9.44	54.67	32.30	8.74	-.70	.86	-.70	1.31	70BA	C427
C437	0	54.87	32.88	9.01	54.23	33.64	8.32	-.64	.76	-.69	1.21	70GD	C437
C440	0	54.98	31.04	9.37	54.32	31.70	8.66	-.66	.66	-.71	1.17	70BA	C440
C442	0	55.22	30.88	9.67	54.51	31.58	8.96	-.71	.71	-.70	1.22	70BM	C442
C454	0	54.02	30.40	8.34*	53.29	30.98	7.62*	-.72	.58	-.72	1.17	70BA	C454
C458	0	55.27	31.36	9.79	54.64	32.07	9.06	-.63	.71	-.73	1.20	70BM	C458
C475	0	54.50	31.44	8.88	53.93	32.23	8.12	-.58	.78	-.76	1.23	70BA	C475
C477	0	56.09*	32.42	8.80	55.42*	33.13	8.07	-.67	.71	-.74	1.22	70BA	C477
C494	0	57.01X	31.11	9.40	56.34X	31.74	8.63	-.67	.62	-.78	1.20	70BA	C494
C496B	0	53.61*	31.77	10.58*	52.96*	32.52	9.83*	-.65	.75	-.75	1.24	70GF	C496B
C499A	X	54.86	32.09	8.91	54.31	31.94	8.21	-.55 *	-.15 X	-.70	.90X	70BA	C499A
C499B	0	55.02	31.04	9.17	54.31	31.74	8.42	-.70	.70	-.75	1.25	70BA	C499B
C506	0	55.16	31.48	9.25	54.46	32.13	8.60	-.70	.65	-.65	1.16	70BA	C506
C514A	•	55.57	33.01	10.04	54.89	33.85*	9.30	-.68	.84	-.74	1.31	70SF	C514A
C517	0	54.56	29.57*	9.47	53.86	30.37*	8.78	-.69	.79	-.69	1.26	70BC	C517
C538	X	56.79X	35.09X	8.56	55.98*	36.00X	7.85	-.81 *	.91 *	-.71	1.41X	70GX	C538
C541	X	53.83	32.98	8.19*	52.98	33.88*	7.44*	-.85 *	.89	-.75	1.44X	70GF	C541
C546A	0	54.67	31.36	9.02	53.97	32.07	8.31	-.71	.71	-.70	1.22	70BN	C546A
C546B	0	54.17	31.93	9.16	53.47	32.53	8.46	-.70	.60	-.70	1.16	70BC	C546B
C547	0	53.66*	33.30*	9.45	53.11	34.13*	8.73	-.54 *	.84	-.72	1.23	70BC	C547
C574	0	54.04	31.46	9.43	53.35	32.16	8.74	-.69	.70	-.69	1.20	70BC	C574
C576	0	55.15	31.29	9.41	54.46	32.10	8.64	-.69	.81	-.76	1.31	70BC	C576
C600	0	54.76	33.81*	8.87	54.15	34.66X	8.11	-.60	.86	-.75	1.29	70GD	C600
C619	0	54.28	33.18*	9.19	53.58	33.88*	8.59	-.70	.70	-.60 *	1.16	70BC	C619
C620	0	55.30	32.71	10.26*	54.58	33.61	9.57*	-.72	.90 *	-.69	1.34*	70MG	C620
C633	X	55.12	30.97	9.15	54.69	31.56	8.40	-.43 X	.59	-.75	1.05X	70BA	C633
C655	0	55.67	32.05	10.24	54.95	32.85	9.57*	-.72	.81	-.67	1.27	70BL	C655
C677	0	54.57	31.22	9.07	53.80	31.95	8.36	-.77	.73	-.71	1.27	70SC	C677
C690	X	55.60	30.06	8.93	54.24	31.64	8.42	-1.36 X	1.58 X	-.50 X	2.19X	70BN	C690
C719A	0	54.71	29.71	9.38	53.96	30.50	8.79	-.75	.80	-.60 *	1.24	70BA	C719A
C719B	0	55.27	30.58	9.47	54.51	31.29	8.77	-.75	.70	-.70	1.25	70BA	C719B
C750	*	59.56X	32.51	8.59	58.77X	33.24	7.79	-.79	.73	-.80	1.34*	70IC	C750
GRAND MEANS		54.87	31.40	9.33	54.19	32.07	8.62	-.68	.73	-.71	1.23		
SD OF MEANS		.60	.86	.46	.59	.81	.47	.06	.08	.05	.05		
INCLUDED LABS FOR THIS MEAN		44	45	44	44	44	44	45	45	45	45		

L, a, b SPACE ANALYSIS, ADJUSTED DATA
COLOR • COLOR DIFFERENCE
FOR PAINT CHIPS

LAB		SAMPLE D19			SAMPLE D20			DIFFERENCE D20 - D19				INST	
CODE	F	MEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN B	ΔL	ΔA	ΔB	ΔE	CODE	LAB
C121	0	26.62	.78*	1.30X	25.26	1.08X	1.98X	-1.36	.31 X	.69 X	1.55	70BA	C121
C148	0	27.13	-.07	-.75	25.87	-.07	-.65	-1.25	.00	.09	1.26	70BF	C148
C152	0	25.90*	.02	-.51	27.65X	.01	-.50	1.75 X	-.01	.01	1.75	70BA	C152
C166	0	27.35	-.16	-.61	25.94	-.11	-.53	-1.41	.05	.08	1.41	70BA	C166
C183	0	27.26	-.58*	-.77	25.75	-.57*	-.77	-1.51	.00	-.01	1.51	70BA	C183
C241	0	27.24	.15	-.46	25.58	.20	-.37	-1.66	.06	.08	1.66	70BF	C241
C255	0	27.22	.01	-.68	25.61	.02	-.64	-1.61	.01	.04	1.61	70BA	C255
C256A	0	26.94	-.03	-.74	25.28	.02	-.68	-1.66	.05	.06	1.67	70SC	C256A
C256B	0	27.47	.02	-.82	26.19	.03	-.80	-1.28	.00	.02	1.28	70BC	C256B
C288	0	26.70	.22	-.61	25.29	.32	-.62	-1.41	.11 *	-.01	1.41	70BM	C288
C291	0	27.10	.52	-.65	25.84	.07	-.66	-1.26	-.45 X	-.01	1.33	70BA	C291
C317	0	26.87	-.01	-.64	25.56	-.01	-.65	-1.31	.01	-.01	1.31	70BM	C317
C325	0	26.84	.15	-.70	25.69	.15	-.70	-1.15	.01	-.01	1.15	70BC	C325
C356	0	25.88*	.08	-1.06	24.60*	.10	-1.02	-1.28	.02	.04	1.28	70IC	C356
C380	0	27.23	-.09	-.67	25.92	-.08	-.63	-1.31	.00	.04	1.31	70BA	C380
C382	0	27.20	-.06	-.48	26.04	-.11	-.44	-1.16	-.05	.04	1.16	70BA	C382
C390	0	27.61	.48	-.91	26.30	.54*	-.92	-1.31	.06	-.01	1.31	70BF	C390
C402	0	27.36	-.08	-.56	25.93	-.06	-.53	-1.43	.02	.04	1.43	70BA	C402
C420A	0	26.99	-1.89X	-1.18*	25.54	-1.94X	-1.13*	-1.46	-.04	.04	1.46	70BF	C420A
C420B	0	26.91	-1.64X	-1.07	25.51	-1.69X	-1.08	-1.40	-.04	-.01	1.40	70BF	C420B
C427	0	27.24	.89X	-.74	25.93	.99X	-.74	-1.31	.11 *	-.00	1.31	70BA	C427
C437	X	27.10	-.05	-.56	26.93*	-.05	-.57	-.17 X	.00	-.01	17X	70GD	C437
C440	0	27.22	-.02	-.32	25.77	-.02	-.30	-1.45	-.00	.02	1.45	70BA	C440
C442	0	26.70	.24	-.61	25.29	.25	-.62	-1.41	.00	-.01	1.41	70BM	C442
C454	0	27.35	-.15	.21X	25.86	-.14	.23X	-1.49	.01	.02	1.49	70BA	C454
C458	0	27.31	.05	-.43	25.55	.09	-.38	-1.76 *	.04	.05	1.76	70BM	C458
C475	0	27.25	-.18	-.52	25.79	-.17	-.47	-1.46	.01	.06	1.46	70BA	C475
C477	0	28.22*	-.26	-.94	26.78*	-.22	-.86	-1.44	.03	.08	1.44	70BA	C477
C494	0	28.27*	-.59*	-1.02	26.66*	-.41	-.95	-1.60	.17 X	.07	1.61	70BA	C494
C496B	0	26.78	-1.23X	1.44X	25.29	-1.27X	1.64X	-1.49	-.05	.20 X	1.51	70GF	C496B
C499A	0	27.46	.01	-.83	25.60	.02	-.80	-1.86 *	.01	.04	1.86*	70BA	C499A
C499B	0	27.31	-.19	-.75	26.10	-.13	-.75	-1.20	.05	-.01	1.21	70BA	C499B
C506	0	27.18	.04	-.68	25.97	.04	-.59	-1.20	.00	.09	1.21	70BA	C506
C514A	+	27.48	.04	-.79	26.31	.08	-.74	-1.17	.03	.05	1.17	70SF	C514A
C517	0	26.88	-.54	-.50	25.84	-.53	-.45	-1.04	.01	.05	1.04	70BC	C517
C538	0	28.19*	1.88X	-2.00X	26.87*	1.77X	-2.05X	-1.32	-.11 X	-.05 *	1.32	70GX	C538
C541	0	26.52	.03	-.85	25.17	.01	-.81	-1.35	-.02	.05	1.35	70GF	C541
C546A	0	27.13	.19	-.78	25.82	.19	-.69	-1.31	.01	.09	1.31	70BM	C546A
C546B	0	26.88	.21	-.83	25.12	.22	-.83	-1.76 *	.01	-.00	1.76	70BC	C546B
C547	0	25.11X	.13	-.81	23.75X	.16	-.82	-1.36	.03	-.02	1.36	70BC	C547
C574	0	26.97	.06	-.77	25.49	-.63*	-.67	-1.48	-.69 X	.09	1.63	70BC	C574
C576	0	27.10	.11	-.57	25.65	.16	-.54	-1.44	.05	.03	1.45	70BG	C576
C600	0	27.63	-.62*	-.16*	26.07	-.61*	-.17*	-1.56	.01	-.01	1.56	70GE	C600
C619	0	26.89	.31	-.89	25.39	.32	-.80	-1.51	.00	.09	1.51	70BC	C619
C620	0	26.38	.15	-.91	24.86	.19	-.87	-1.52	.05	.04	1.52	70MG	C620
C633	0	27.27	-.14	-.63	25.93	-.10	-.61	-1.34	.04	.02	1.34	70BA	C633
C655	0	27.11	.03	-.89	25.80	.05	-.87	-1.31	.02	.03	1.31	70BC	C655
C677	0	26.15	-.23	-1.31*	24.99	-.24	-1.21*	-1.16	-.01	.10	1.17	70SC	C677
C690	X	26.72	.10	-.84	26.70*	.47	-.84	-.02 X	.37 X	.00	37X	70BM	C690
C719A	0	26.78	-.26	-.40	25.64	-.50	-.46	-1.15	-.25 X	-.06 *	1.17	70BA	C719A
C719B	0	27.06	-.19	-.58	25.95	-.14	-.59	-1.10	.06	-.01	1.11	70BA	C719B
C750	#	30.01X	-.22	-2.21X	28.20X	-.18	-2.23X	-1.81 *	.05	-.02	1.81*	70IC	C750
GRAND MEANS													
		27.09	-.01	-.72	25.72	-.04	-.69	-1.40	.02	.03	1.41		
SD OF MEANS													
		.49	.28	.23	.45	.26	.22	.18	.03	.04	.19		
INCLUDED LABS FOR THIS MEAN													
		47	43	44	46	42	44	47	42	46	48		

NOTES ON NBS REFLECTANCE VALUES

The tables on page 23 of this report contain absolute reflectance values measured at 40 wavelengths (380-770 nm) and tristimulus values for three of the five samples covered by this report. The measurements were performed by the Radiometric Physics Division of the National Bureau of Standards.

These values represent state-of-the-art color measurements on a single specimen of each sample. Thus the results give an accurate picture of the values for single specimens and are not an accurate measure of the whole sample population. Participants should be aware of this concept when comparing their measurements to these NBS values.

NBS VALUES FOR SPECTRAL REFLECTANCE

45/0 REFLECTANCE FACTOR

Samples D17, D19, W20

WAVELENGTH (nm)	D17	D19	W20
380	.1129	[illegible]	[illegible]
390	.1727	.0663	.2254
400	.2409	.0744	.4391
410	.2605	.0766	.7034
420	.2520	.0767	.8433
430	.2423	.0765	.8778
440	.2384	.0763	.8859
450	.2337	.0760	.8910
460	.2304	.0756	.8961
470	.2312	.0751	.8996
480	.2242	.0748	.9051
490	.2074	.0744	.9064
500	.1981	.0741	.9093
510	.1976	.0737	.9112
520	.1884	.0735	.9126
530	.1772	.0731	.9143
540	.1802	.0729	.9153
550	.2067	.0727	.9157
560	.2398	.0727	.9159
570	.2611	.0729	.9165
580	.3318	.0731	.9172
590	.4586	.0730	.9175
600	.5554	.0728	.9168
610	.5984	.0724	.9164
620	.6138	.0721	.9164
630	.6188	.0717	.9181
640	.6196	.0712	.9156
650	.6191	.0709	.9164
660	.6180	.0705	.9147
670	.6168	.0702	.9104
680	.6155	.0698	.9119
690	.6142	.0695	.9166
700	.6130	.0693	.9149
710	.6116	.0689	.9178
720	.6098	.0686	.9145
730	.6085	.0683	.9145
740	.6075	.0679	.9141
750	.6061	.0677	.9137
760	.6049	.0675	.9154
770	.6034	.0672	.9158

SAMPLES D17, D19, W20

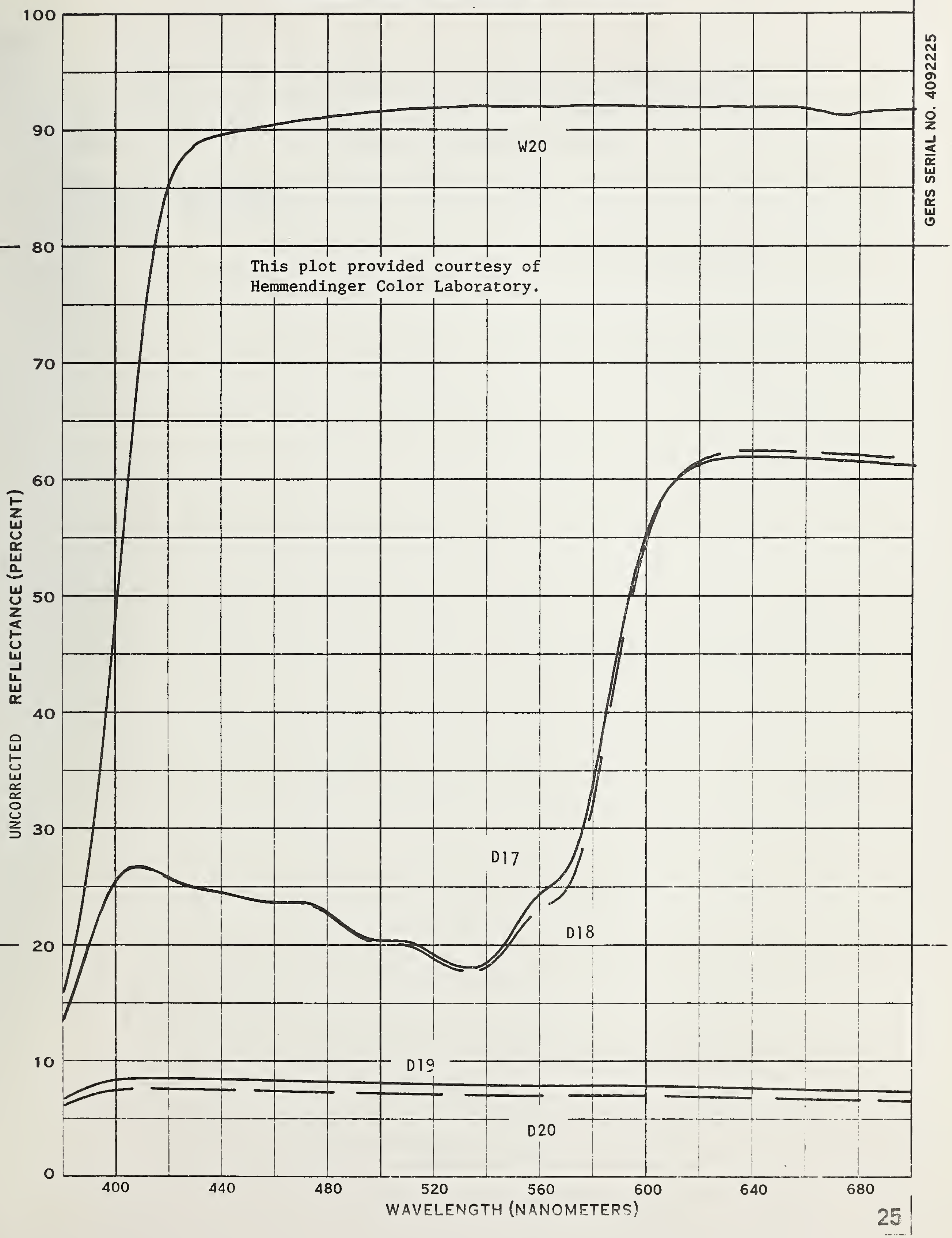
X, Y, Z SPACE

	D17	D19	W20
X	39.59	7.12	89.16
Y	30.55	7.25	91.44
Z	27.32	8.88	104.65

L, a, b SPACE

	D17	D19	W20
L	55.27	26.93	95.62
a	31.13	.08	-.91
b	9.38	-.71	2.05

SPECTROPHOTOMETRIC CURVES OF COLOR AND COLOR DIFFERENCE FOR PAINT CHIPS NO. 31 SAMPLES



This plot provided courtesy of Hemmendinger Color Laboratory.

Notes on Specific Laboratory Results for Near White Papers

C285 - Specular component excluded

C662, C717A, C717B, C720A, C720B, C727A C727B - Used illuminant D65

MCCA COLLABORATIVE REFERENCE PROGRAM
X. Y. Z SPACE ANALYSIS, NORMAL DATA
COLOR + COLOR DIFFERENCE
FOR NEAR WHITE PAPERS

LAB		SAMPLE P05			SAMPLE P06			DIFFERENCE P06 - P05				INST	
CODE	F	MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ	ΔE	CODE	LAB
C162	O	84.10*	85.58*	97.69*	83.51X	85.03X	96.46*	-.59	-.55	-1.23	.95	71DC	C162
C244	O	81.37	82.95	93.94	80.58	82.22	92.32	-.79	-.73	-1.62	1.25	71ZE	C244
C313	O	82.16	83.65	95.07	81.24	82.71	92.72	-.92	-.93	-2.35	2.15	71ZE	C313
C446	O	81.57	83.39	94.37	81.00	82.83	93.48	-.57	-.56	-.89	.70	71GE	C446
C662	+	79.49	83.28	87.45*	78.98*	82.77	86.40*	-.51	-.50	-1.05	.91	71SP	C662
C716	O	81.23	83.06	94.24	80.70	82.40	92.93	-.53	-.66	-1.31	1.55	71ZE	C716
C717A	+	79.63	83.34	87.72*	79.11*	82.86	86.53*	-.52	-.48	-1.19	1.02	71SP	C717A
C717B	+	79.98	83.72	88.08*	79.37	83.13	86.92	-.62	-.60	-1.16	.94	71SF	C717B
C720A	+	79.60	83.38	87.42*	79.02*	82.80	86.37*	-.58	-.57	-1.05	.87	71SP	C720A
C720B	+	79.40	83.16	87.33*	78.83*	82.60	86.28*	-.57	-.56	-1.05	.86	71SF	C720B
C727A	+	79.48	83.30	87.36*	79.03*	82.85	86.59*	-.44	-.44	-.77	.64	71SP	C727A
C727B	+	79.51	83.32	87.52*	78.71*	82.88	86.67	-.79	-.43	-.85	1.81	71SF	C727B
GRAND MEANS													
		82.09	83.73	95.06	80.88	82.54	93.58	-.68	-.69	-1.48	1.32		
SD OF MEANS													
		1.18	1.07	1.53	.30	.28	1.66	.17	.16	.55	.57		
INCLUDED LABS FOR THIS MEAN													
		5	5	5	4	4	5	5	5	5	5		

MCCA COLLABORATIVE REFERENCE PROGRAM
L, a, b SPACE ANALYSIS, NORMAL DATA
COLOR + COLOR DIFFERENCE
FOR NEAR WHITE PAPERS

LAB		SAMPLE P05			SAMPLE P06			DIFFERENCE P06 - P05				INST	
CODE	F	MEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN B	ΔL	ΔA	ΔB	ΔE	CODE	LAB
C105	0	91.38	-.20	2.38	91.03	-.30	2.85	-.35	-.10	.47	.60	71HN	C105
C122	0	91.39	-.20	2.49	91.06	-.23	2.87	-.32	-.03	.38	.50	71SC	C122
C128	0	91.10	-.20	2.70	90.74	-.14	2.94	-.36	.06	.24	.44	71SC	C128
C148	0	92.13	-.57	3.14*	91.79	-.54	3.17	-.34	.03	.03	.34	71HF	C148
C150	0	92.20	-.70	2.68	92.00	-.72	3.00	-.20	-.02	.33	.38	71BA	C150
C213	0	90.70	-.20	2.40	90.39	-.20	2.80	-.31	-.00	.40	.51	71SC	C213
C222	0	92.46*	-.49	2.15	92.23	-.66	2.52	-.23	-.17	.37	.47	71BA	C222
C225	0	91.00	-.20	2.40	90.66	-.29	2.79	-.34	-.09	.39	.52	71SC	C225
C226	0	91.39	-.33	2.40	90.99	-.36	2.83	-.40	-.03	.43	.58	71BA	C226
C230	0	91.38	-.45	2.43	90.95	-.46	2.85	-.44	-.01	.42	.61	71BA	C230
C262	0	91.42	-.40	2.12	90.95	-.49	2.99	-.47	-.09	.87	.99	71BC	C262
C285	•	91.44	-.68	3.25*	91.10	-.93	4.43*	-.35	-.25 *	1.19	1.26	71SF	C285
C301	0	91.38	-.18	2.40	90.89	-.29	3.53	-.49	-.11	1.13	1.24	71BN	C301
C320	0	92.10	-.58	2.80	92.23	-.99	4.02*	.13 *	-.41 X	1.23 *	1.30	71BA	C320
C324	0	91.63	-.33	2.57	91.51	-.39	3.35	-.12	-.06	.79	.80	71BA	C324
C328	0	91.33	-.76	2.48	90.49	-1.08	3.56	-.84 *	-.32 X	1.08	1.40*	71BA	C328
C340	0	91.92	-.37	2.34	91.72	-.60	2.63	-.20	-.23 *	.29	.42	71BA	C340
C352	0	92.10	-.40	2.30	91.90	-.48	2.62	-.20	-.08	.32	.38	71BA	C352
C442	0	91.24	-.50	2.50	90.96	-.50	2.74	-.28	.00	.24	.37	71BM	C442
C456	0	91.40	-.35	1.98	91.00	-.46	2.70	-.40	-.12	.72	.83	71BA	C456
C571	0	91.01	-.01	2.80	90.26	-.15	3.84	-.75 *	-.15	1.04	1.30	71BA	C571
C585	0	91.63	-.10	2.31	91.39	-.09	2.81	-.24	.01	.50	.56	71SC	C585
C670	0	91.47	-1.26X	3.57X	91.23	-1.30*	3.83	-.24	-.04	.27	.36	71SC	C670
C702	0	91.98	-.03	2.60	92.68*	-.52	3.58	.70 X	-.50 X	.98	1.30	71BA	C702
C706	0	91.29	-.40	2.25	90.88	-.40	2.61	-.41	.00	.36	.55	71BA	C706
C713	0	93.87X	.28*	2.59	93.48X	.30*	3.02	-.39	.02	.43	.58	71BA	C713
GRAND MEANS													
		91.54	-.32	2.47	91.25	-.45	3.06	-.34	-.06	.55	.69		
SD OF MEANS													
		.44	.23	.25	.63	.33	.43	.19	.07	.33	.35		
INCLUDED LABS FOR THIS MEAN													
		24	24	24	24	25	25	24	22	25	25		

EXPLANATION OF DATA FOR WHITE SAMPLE FOR NEAR WHITE PAPERS

Specimens of a white calibration sample (Paint Chips) were distributed to the participants along with the two sets of eight near white papers, and each participant was asked to return measurement data for the white calibration sample (Paint Chips), reporting results in the same manner as for the near white papers.

As a first step, three laboratories were selected to serve as "reference" laboratories for the purposes of this analysis and the average of their X, Y, Z values for the white sample were computed. Next, the ratios of the participants data to the combined reference laboratory values were calculated for each participant (transformed to X, Y, Z space if necessary). These ratios are shown in the White Sample Analysis table.

Two observations can be made about the data in the White Sample Analysis tables. First, the participants as a whole tend to be high compared with the combined average values obtained by the selected reference laboratories. Second, a few participants have noticeably extreme values for one or more of the components and these participants especially should look to the cause.

Next, the ratios in the White Sample Analysis tables were used to "adjust" the data of the normal data tables to obtain the adjusted data tables values The adjustment consisted of dividing the X, Y, Z values of the normal data tables by the respective ratios in the White Sample Analysis tables.

The significant change is the adjusted data tables is in the SD OF MEANS. Comparison of these among-laboratory standard deviations with those in the normal data tables, shows considerable reduction for X, Y, Z. Thus part, at least, of the disagreement among participants is due to errors in standarization that could be corrected through use of an agreed-upon white standard. There is no similar significant change for ΔX, ΔY, and ΔZ.

WHITE SAMPLE ANALYSIS FOR NEAR WHITE PAPERS
X, Y, Z LABORATORIES

LAB CODE	RATIO--(LAB/COMBINED) X	Y	Z	INST CODE	PERCENT FROM COMBINED X	Y	Z
C162	1.0151	1.0126	1.0189	71DC	1.51	1.26	1.89
C244	.9966	.9955	.9984	71ZE	-.34	-.45	-.16
C313	1.0052	.9999	1.0084	71ZE	.52	-.01	.84
C446	.9994	.9987	1.0035	71GE	-.06	-.13	.35
C662	.9598	.9956	.9241	71SP	-4.02	-.44	-7.59
C716	.9268	.9201	.9058	71ZE	-7.32	-7.99	-9.42
C717A	.9726	.9963	.9263	71SP	-2.74	-.37	-7.37
C717H	.9766	1.0011	.9319	71SP	-2.34	.11	-6.81
C720A	.9724	.9967	.9261	71SP	-2.76	-.33	-7.39
C720H	.9698	.9942	.9256	71SP	-3.02	-.58	-7.44
C727A	.9726	.9970	.9272	71SP	-2.74	-.30	-7.28
C727H	.9739	.9984	.9279	71SP	-2.61	-.16	-7.21

WHITE SAMPLE ANALYSIS FOR NEAR WHITE PAPERS
L, a, b LABORATORIES

LAB CODE	RATIO--(LAB/COMBINED) X	Y	Z	INST CODE	PERCENT FROM COMBINED X	Y	Z
C105	.9921	.9891	1.0099	71HM	-.79	-1.09	.99
C122	.9849	.9828	.9951	71SC	-1.51	-1.72	-.49
C128	.9852	.9828	.9928	71SC	-1.48	-1.72	-.72
C148	.9951	.9932	1.0011	71HF	-.49	-.68	.11
C150	.9983	.9977	1.0076	71HA	-.17	-.23	.76
C213	.9769	.9746	.9859	71SC	-2.31	-2.54	-1.41
C222	1.0048	1.0060	1.0180	71HA	.48	.60	1.80
C225	.9836	.9818	.9925	71SC	-1.64	-1.82	-.75
C226	.9622	.9581	.9585	71HA	-3.78	-4.19	-4.15
C230	.9916	.9898	1.0034	71HA	-.84	-1.02	.34
C262	.9925	.9914	1.0048	71HC	-.75	-.86	.48
C285	.9804	.9827	.9760	71SR	-1.96	-1.73	-2.40
C301	.9894	.9870	.9986	71HM	-1.06	-1.30	-.14
C320	.9496	.9438	.9313	71HA	-5.04	-5.62	-6.87
C324	.9898	.9880	.9981	71HA	-1.02	-1.20	-.19
C328	.9111	.9100	.9000	71HA	-8.89	-9.00	-10.00
C340	.9913	.9907	1.0030	71HA	-.87	-.93	.30
C352	.9988	.9964	1.0120	71HA	-.12	-.36	1.20
C442	.9861	.9849	.9949	71HM	-1.39	-1.51	-.51
C456	.9907	.9885	1.0087	71HA	-.93	-1.15	.87
C571	.9396	.9322	.9194	71HA	-6.04	-6.78	-8.06
C585	.9396	.9322	.9194	71SC	-6.04	-6.78	-8.06
C670	.9768	.9820	.9729	71SC	-2.32	-1.80	-2.71
C702	.9478	.9418	.9307	71HA	-5.22	-5.82	-6.93
C706	.9746	.9704	.9741	71HA	-2.54	-2.96	-2.59
C713	1.0450	1.0396	1.0477	71HA	4.50	3.96	4.77

MCCA COLLABORATIVE REFERENCE PROGRAM
X, Y, Z SPACE ANALYSIS, ADJUSTED DATA
COLOR + COLOR DIFFERENCE
FOR NEAR WHITE PAPERS

LAB		SAMPLE P05			SAMPLE P06			DIFFERENCE P06 - P05				INST	
CODE	F	MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ	ΔE	CODE	LAB
C162	O	82.85X	84.52	95.89X	82.28*	83.97	94.68	-.58	-.54	-1.21	.94	71DC	C162
C244	O	81.64	83.33	94.09	80.85	82.60	92.47	-.79	-.73	-1.63	1.25	71ZE	C244
C313	O	81.73	83.66	94.28	80.82	82.72	91.95	-.92	-.94	-2.33	2.14	71ZE	C313
C446	O	81.63	83.50	94.04	81.05	82.94	93.16	-.58	-.56	-.89	.70	71GE	C446
C662	+	82.82	83.65	94.64	82.30	83.14	93.50	-.53	-.51	-1.14	.94	71SF	C662
C716	O	87.65X	90.28X	104.04X	87.08X	89.56X	102.60X	-.57	-.72	-1.44	1.59	71ZE	C716
C717A	+	81.87	83.65	94.71	81.34	83.16	93.42	-.53	-.48	-1.28	1.05	71SF	C717A
C717B	+	81.90	83.64	94.51	81.27	83.04	93.27	-.63	-.59	-1.24	.96	71SF	C717B
C720A	+	81.87	83.65	94.40	81.27	83.08	93.27	-.60	-.58	-1.13	.89	71SF	C720A
C720B	+	81.87	83.64	94.36	81.28	83.08	93.22	-.59	-.56	-1.13	.88	71SF	C720B
C727A	+	81.72	83.55	94.22	81.27	83.10	93.39	-.46	-.45	-.83	.65	71SF	C727A
C727B	+	81.64	83.45	94.32	80.82	83.01	93.40	-.82	-.44	-.92	1.83	71SP	C727B
GRAND MEANS		81.67	83.75	94.14	81.25	83.06	93.06	-.69	-.70	-1.50	1.32		
SD OF MEANS		.06	.53	.12	.69	.63	1.18	.16	.16	.54	.57		
INCLUDED LABS FOR THIS MEAN		3	4	3	4	4	4	5	5	5	5		

MCCA COLLABORATIVE REFERENCE PROGRAM
L, a, b SPACE ANALYSIS, ADJUSTED DATA
COLOR • COLOR DIFFERENCE
FOR NEAR WHITE PAPERS

LAB		SAMPLE P05			SAMPLE P06			DIFFERENCE P06 - P05				INST	
CODE	F	MEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN B	ΔL	ΔA	ΔB	ΔE	CODE	LAB
C105	0	91.88	-.69	3.67	91.53	-.79	4.13	-.35	-.10	.46	.59	71BM	C105
C122	0	92.18	-.55	3.28	91.86	-.57	3.65	-.33	-.02	.37	.50	71SC	C122
C128	0	91.89	-.59	3.34	91.53	-.53	3.58	-.36	.06	.24	.44	71SC	C128
C148	0	92.44	-.87	3.64	92.10	-.84	3.66	-.34	.03	.02	.34	71BF	C148
C150	0	92.31	-.79	3.29	92.11	-.81	3.61	-.21	-.02	.32	.38	71BA	C150
C213	0	91.88	-.59	3.14	91.56	-.59	3.54	-.31	.00	.40	.51	71SC	C213
C222	0	92.19	-.30	2.88	91.96	-.47	3.24	-.23	-.17	.36	.46	71BA	C222
C225	0	91.84	-.50	3.09	91.50	-.59	3.48	-.34	-.09	.39	.52	71SC	C225
C226	0	93.37	-1.03	2.48	92.96	-1.05	2.91	-.41	-.02	.43	.60	71BA	C226
C230	0	91.85	-.73	3.28	91.41	-.74	3.70	-.44	-.01	.42	.61	71BA	C230
C262	0	91.82	-.58	2.96	91.35	-.67	3.82	-.47	-.09	.86	.98	71BC	C262
C285	•	92.24	-.30	2.85	91.89	-.55	4.06	-.35	-.25 *	1.21	1.28	71SB	C285
C301	0	91.98	-.57	3.14	91.49	-.68	4.26*	-.49	-.11	1.12	1.23	71BM	C301
C320	0	94.81	-1.59*	2.02	94.93*	-2.02X	3.30	.13 *	-.43 X	1.28 *	1.36	71BA	C320
C324	0	92.18	-.62	3.21	92.06	-.69	3.99	-.13	-.06	.79	.80	71BA	C324
C328	0	95.74*	-.99	1.88	94.86	-1.32	3.04	-.88 *	-.33 X	1.15	1.48*	71BA	C328
C340	0	92.35	-.47	3.11	92.15	-.70	3.40	-.21	-.23 *	.29	.42	71BA	C340
C352	0	92.27	-.80	3.27	92.07	-.88	3.58	-.20	-.08	.31	.38	71BA	C352
C442	0	91.94	-.70	3.14	91.65	-.70	3.38	-.29	.00	.24	.37	71BM	C442
C456	0	91.93	-.70	3.24	91.53	-.81	3.94	-.41	-.11	.70	.82	71BA	C456
C571	0	94.26	-1.30	2.02	93.48	-1.45	3.13	-.78 *	-.14	1.11	1.36	71BA	C571
C585	0	94.90	-1.40	1.50*	94.65	-1.40	2.03X	-.25	.01	.53	.59	71SC	C585
C670	0	92.30	-.42	3.02	92.07	-.46	3.30	-.24	-.04	.27	.36	71SC	C670
C702	0	94.78	-1.08	1.92	95.50*	-1.60*	2.94	.72 X	-.52 X	1.02	1.35	71BA	C702
C706	0	92.67	-1.09	2.52	92.25	-1.09	2.89	-.42	.00	.37	.56	71BA	C706
C713	0	92.06	-.56	3.02	91.68	-.53	3.43	-.38	.02	.41	.56	71BA	C713
GRAND MEANS		92.71	-.78	2.88	92.41	-.83	3.49	-.35	-.05	.55	.70		
SD OF MEANS		1.18	.32	.58	1.25	.32	.37	.20	.07	.35	.37		
INCLUDED LABS FOR THIS MEAN		25	25	25	25	24	24	24	22	25	25		

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☐ Document describes a computer program; SF-185, FIPS Software Summary, is attached.

16. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)*

Collaborative Reference Programs provide participating laboratories with the means for checking periodically the level and uniformity of their testing in comparison with that of other participating laboratories. An important by-product of the programs is the provision of realistic pictures of the state of the testing art. This is one of the periodic reports showing averages for each participant, within and between laboratory variability, and other information for participants and standards committees.

17. KEY WORDS *(six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)*

Collaborative reference program; Color; Laboratory evaluation; Precision; Reference samples; Testing calibration

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